DOCUMENT RESUME

ED 272 161 IR 012 215

AUTHOR	Guha, Bimalendu
TITLE	Study on the Language Barrier in the Production, Dissemination and Use of Scientific and Technical Information with Special Reference to the Problems of the Developing Countries.
INSTITUTION	United Nations Educational, Scientific and Cultural Organization, Paris (France). General Information Programme.
REPORT NO	PGI-85/WS/34
PUB DATE	Dec 85
NOTE	73p.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Developed Nations; *Developing Nations; Global Approach; *Information Dissemination; *Information Processing; Information Retrieval; *Intercultural Communication; Language Patterns; Language Processing; *Scientific and Technical Information; *Second Languages; Translation
IDENTIFIERS	*Language Barriers

ABSTRACT

This study is concerned with linguistic obstacles in the production, transmission, and dissemination of scientific and technical information at the international level. Special reference is made to the problems of developing nations. Following brief discussions of the early use of language, the beginning of diversity of languages, diversity of languages in science and technology, and concerns at the international level, the paper is divided into five major sections. The first provides basic data on the language distribution of the scientific and technical literature, including the approximate numbers of scientific works published each year in the major languages and the language distribution of items in major abstracting/indexing periodicals. Use patterns are examined in the second section through analyses of such areas as the percentages of the literature read in English by research workers in different language areas and amount of borrowing from the library in various disciplines and languages. The third section discusses the foreign language problem in English language countries in the context of the linguistic abilities of the researchers, the amount of research in various scientific disciplines done in different countries, and steps that have been taken to overcome the language barrier for French, German, Russian, and Japanese. The point of view of developing countries is addressed in the fourth section, which includes a detailed case study of the scientific language situation in India. The fifth section explores ways in which researchers cope with language barriers, and suggests sources where they may find help, ranging from colleagues to translation services. Fourteen recommendations designed to ease language barrier problems conclude the report. A 78-item bibliography is included. (THC)

ED272161

U.S. DEPARTMENT OF EDUCATION
OERI
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official position or policy.

PGI-85/WS/34

Study on the language barrier in the production, dissemination and use of scientific and technical information with special reference to the problems of the developing countries

Reproduced by permission of

UNESCO

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

C. Coudert-Schklowski

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

General Information Programme and UNISIST

United Nations Educational,
Scientific and Cultural Organization

Paris, 1985

IR012215

Original English

PGI-85/WS/34
Paris, December 1985

STUDY ON THE LANGUAGE BARRIER IN THE PRODUCTION, DISSEMINATION AND USE OF SCIENTIFIC AND TECHNICAL INFORMATION WITH SPECIAL REFERENCE TO THE PROBLEMS OF THE DEVELOPING COUNTRIES

prepared by
Bimalendu GUHA

General Information Programme and UNISIST

United Nations Educational,
Scientific and Cultural Organization

Recommended catalogue entry :

Guha, Bimalendu
Study on the language barrier in the production, dissemination and use of scientific and technical information with special reference to the problems of the developing countries prepared by Bimalendu Guha /for the/ General Information Programme and UNISIST. - Paris : Unesco, 1985. - 66 p.; 30 cm.- (PGI-85/WS/34).

I - Study on the language barrier in the production, dissemination and use of scientific and technical information with special reference to the problems of the developing countries

II - Unesco. General Information Programme and UNISIST

© Unesco, 1985

A STUDY

ON THE LANGUAGE BARRIER IN THE PRODUCTION DISSEMINATION AND USE OF SCIENTIFIC AND TECHNICAL INFORMATION WITH SPECIAL REFERENCE TO THE PROBLEMS OF THE DEVELOPING COUNTRIES

BY

B GUHA
Professor, Department of Library & Information Science
Banaras Hindu University
Varanasi - 221005
INDIA

CONTENTS

Pages

INTRODUCTION 1-3

The early use of the language – Beginning of diversity of languages – Diversity of languages in science and technology – Concern at the international level

THE BASIC DATA ON THE LANGUAGE OF SCIENTIFIC AND TECHNICAL PUBLICATIONS 4-15

The language distribution of world population – Language distribution of scientific and technical literature – Coverage in secondary publications – Bias in the coverage – Language distribution in more specific subjects – Language breakdown of primary journals – Heavy concentration in a few major languages – Different angles to look at the language barrier – Languages of the secondary literature – Discrepancy between primary and secondary document languages – Carrier languages of on-line data bases – Some developments in the languages of secondary literature – Significance of the success of Excerpta Medica – Rise of multi-series abstracting services in non-English countries – Growth of national abstracting services – Which way the data bases will go? – Language barrier at two levels – Concentration in a few languages

THE USE PATTERN OF SCIENTIFIC LITERATURE 16-21

National and language bias in the use of scientific literature – Use of English language literature in various countries – Comparison of the two views – National and language bias in a specific field – Other ways of datermining the use of literature – Sheffield survey on the use of foreign language material – Indication of a language barrier

DIFFERENT ASPECTS OF THE FOREIGN LANGUAGE PROBLEM IN AN ENGLISH LANGUAGE COUNTRY 22-28

The language barrier in Britain – Foreign language problems faced by information users – Three surveys – Language ability – Awareness of the value of research in other countries – How often a foreign language document is encountered – Steps taken to read foreign language documents – Lack of awareness about translation services and tools – Recommendations of the surveys

THE POINT OF VIEW OF DEVELOPING COUNTRIES 29-39

Importers of information – Developing countries having favoured languages – The Indian scene – Dependence on foreign sources of information – Dependence on English language periodicals – National survey of translation needs of India – Other aspects of the Indian translation scene

BEHAVIOUR OF INFORMATION SEEKERS IN THE FACE OF LANGUAGE BARRIER 40-59

Eagerness to disseminate and the necessity to get access to information – Language strategy – The case of Japan – More emphasis as users of information – How people come to know about foreign language documents – Indexes of translation – How to locate and obtain translations – Translation pools in Britain – Translation pools in the United States – International Translation Centre – The translation scene in the USSR – Index Translationum – Cover-to-cover translation of journals – The scenario in non-English countries – Machine translation

RECOMMENDATIONS 60-61

REFERENCES 62-66

The Early Use of the Language

A language has always been an important and powerful instrument in fostering a sense of oneness in any community. In a primitive community better articulation and command over the spoken word had often determined the leadership. Some sociologists even believe that the priests who wielded such influence in any group of people, from the king to the commoner, were basically persons with better articulation and who could use the language of the community in a better way. The king, of course, wielded power with his sword. In course of time, with the development of the written word another group of people came to the fore. They were the people who could use the written word better than others. They had one great advantage in that they could reach out to more people and the written word, by its very nature, had a more compulsive appeal. The realisation and acceptance of this social phenomenon must have prompted thinkers to use such expressions as, the pen is mightier than the sword, knowledge is power, and so on. In every language there are likely to be similar expressions.

The power of the written word has been enhanced many times more with the invention and spread of printing. The printed word, especially as print-on-paper documents, could be carried easily across the barriers of countries and continents. Such documents could be produced in any number, could be read at one's own pace and convenience, and the same document could be used again and again by different people at different times. In the meantime the advancement in telecommunication technology, in the shape of radio and television, has again made the spoken word almost equally important. In the olden days one could be heard only to the extent his voice could carry him. Today, the human voice can be carried from one place to any other place across all barriers.

Beginning of Diversity of Languages

The above is the general picture that usually emerges when we ponder over the spectacular technological advancements that have been made by man during the last few centuries. Truly, the world has become smaller in size. However, there appears to be one snag or at least one presumption in this highly promising picture. The language in which a person expresses himself, either in speaking or writing, is understood by all those in distant places to whom modern technology is capable of transmitting his voice or writings. If not, then we have to accept that there is at least one barrier to this seemingly free flow of ideas, experience and information. This is being conceived as the language barrier.

It is quite natural that two different communities having different cultural background and inhabiting different geographical locations will be using diverse languages for their respective social, cultural and economic needs. This has impeded contact between people. This is the Biblical curse of the Tower of Babel. However, throughout the centuries, many different solutions have been improvised to get over the language barrier. These improvisations have been according to the varying requirements of the various fields of human interaction, such as trade and commerce, travel, spread of religion, law, science and technology, literature, etc. As we are more concerned with the

linguistic obstacles in the production, transmission and dissemination of scientific and technical information, we shall view the problem of the language barrier more from this angle.

Diversity of Languages in Science and Technology

The effects of the curse of the Tower of Babel and the consequent diversity of languages are being felt in the field of science and technology only in recent years compared to other fields of human activity and interaction. Analysing the problems of bibliographical organisation of scientific literature in the mid-sixties of the present century, J C Shipman[64] had maintained that they represented in many ways a modern-day response to problems which had their origins in three significant developments of the seventeeth century science. These developments were: a) the invention of the scientific journal, b) increasing use of mathematical expression and formulation, and c) use of vernacular languages in scientific communication. The evidence of the third feature becomes apparent if it is recalled that Gallileo used the language of his native Tuscany in his *Dialogo*, Descartes wrote his *Discours* in French, and Newton's *Opticks* first appeared in English. This language shift, from Latin which was the traditional common language of scholarship, "in the scientific literature of Western Europe was apparently a deliberate move, reflecting in some measure the growing national audiences for science, audiences either unfamiliar with Latin or impatient with its use in communicating and disseminating the exciting new knowledge of the day. In any event, the advantages of an existing international scholarly language were increasingly ignored, even as the volume of published scientific work mounted throughout Europe, and finally, throughout the world". The half a dozen languages of Western Europe which started carrying the literature of science, in the seventeenth century, have, today multiplied many times. There are quite a few comprehensive abstracting and indexing services which deal with and feature current literature in more than 50 languages. It is paradoxical that the three developments, recognised by Shipman, which did so much to unleash the potential of science three centuries ago, have become the chief obstacles in our current efforts to control and manage the modern literature of science.

Concern at the International Level

Sociologists and other who study the cultural heritage of man find in the diversity of languages a richness which they consider as a 'Treasury of tongues'. But scientists have started feeling the restrictive effects of a language barrier. It is not a new problem, however, its influence seems to be increasing instead of decreasing. This appears to be not only a result of increased international cooperation and communication, but also a result of what is called 'linguistic equality[72]. Information users and professional bodies of translators and information workers have been discussing this problem at various levels and from various angles.

Among the international organizations, Unesco is very much concerned with the problem of language barrier in fully keeping with its fundamental constitutional mission, which stipulates that Unesco will 'maintain, increase and diffuse knowledge' and 'promote the free flow of ideas by word and image'. In conformity with this mission, one of the tasks that has been accepted in the current plan is "to assist in strengthening problem-solving capability by fostering the development and democratization of education and the advancement of science, by increasing and developing the creative potential, both scientific and technological, of all peoples by reinforcing aptitudes and abilities, by developing research and training infrastructures and by promoting the free flow of knowledge and know-how"[66]. It has also been realized that in the realization of

the above task and specially in the improvement of access, availability and use of information one important obstacle is likely to be a language barrier. Hence, some detailed information about the nature and intensity of this problem is necessary before any specific programme can be initiated as remedial measure.

It is not only flow or use of information that is important. Communication is also equally important. This has been emphasised by Marcel van Dijk in the following words – "The post-industrial society we are entering will be one of development of creative and intellectual capacities. It will be a society of information and of communication, and it will be able to bring peace if mean not only communicate, but also, and above all, understand each other. Tomorrow, even machines will obey the spoken voice and will speak ... but in what language?"

THE BASIC DATA ON THE LANGUAGE OF SCIENTIFIC AND TECHNICAL PUBLICATIONS

The Language Distribution of World Population

Experts estimate that approximately 3000 languages are in use throughout the world. There are more than a hundred languages with a million or more speakers each. But there are only thirteen languages each of which can claim more than fifty million speakers. These major languages are: Chinese, English, Hindustani (Hindi), Spanish, Russian, German, Japanese, Indonesian, French, Italian, Portuguese, Arabic, and Bengali[9, 56]. Some of these languages, e.g. English and Spanish are used by people in a number of countries spread over vast areas. On the other hand there are languages which have very little use outside their own area. Chinese, for example, which has more than 750 million speakers, is almost entirely confined within China. Hindi, with about 300 million speakers, is similarly confined within India.

The importance of a language is measured not only by the number of speakers for whom it is the mother tongue. The number of speakers for whom it is the second language is also important. Further, the volume of publications generated or available in the language is also an important factor. Applying these criteria, the eminent position of the English language becomes quite evident. English is the mother tongue of 8% of world's population, but is the common language of more than 30% of the population and is the language of 22% of the word's published works (UNESCO-1977) and of more than 50% of articles in the world's scientific and technical press[23].

The Language Distribution of Scientific and Technical Literature

One interesting feature of the foreign language barrier in science and technology is that the world's scientific and technical literature has a different distribution pattern than is found in the distribution of world's population by languages as indicated above. Thus, only a small percentage of scientific literature is available in Chinese and almost a negligible amount in Hindi, the two languages which have more than 1050 million speakers between them. As is well known both China and India have been the seats of ancient civilizations. The language distribution of the literature of science and technology can be estimated and presented in various ways, such as by counting the number of books, periodicals and other documents that are published, holdings of bigger libraries, analysis of comprehensive subject bibliographies.

As regards publishing, statistics (Unesco Statistical Yearbook, 1977) show that approximately 25 languages have sizable literary output measured in terms of titles published per annum. Out of them, a dozen languages publish 10 000 or more works per annum out of a total of 550 000 titles published per annum in the world. The share of these major languages are:

English — more than 120 000 works
Russian — more than 60 000 works
German — more than 50 000 works
French Spanish and Japanese — more than 30 000 works each
Italian, Dutch, Swedish, Polish,
Hungarian, Czeck and Korean — about 10 000 works each

coverage of the major abstracting/indexing periodicals. Some estimates of this nature are presented in the following section.

Coverage in Secondary Publications

D N Wood, in his study[76] of 1967 calculated the language-wise coverage of the major abstracting/indexing services which were subsequently revised by Sandra R Ellen in another similar study at the BLLD[24]. In Table 1, the estimates of Ellen are given in parentheses along with Wood's for easy comparism. It would be evident that in about ten years time, English has gained further in most of the services, except the *Chemical Abstracts*.

Table 1

Language-wise distribution of items in the six major abstracting/indexing periodicals (percentages)

	CA	Biol Abst	Phys Abst	Engng Index	Index Medicus	Math Reviews
English	50.3 (47)	75 (79)	75 (87)	82 (93)	51 (76)	54 (65)
Russian	23.4 (27)	10 (8)	17 (6)	3.9 (6)	5.6 (8)	21.4 (18)
German	6.4 (9)	3 (3)	4 (2)	8.6 (6)	17.2 (6)	8.7 (5)
French	7.3 (3)	3 (3)	4 (2)	2.4 (2)	8.6 (3)	7.8 (6)
Japanese	3.6 (8)	1 (1)	0.5 (1)	0.1 (1)	0.9 (1)	0.7 -
Chinese	0.5 -	1.0 -	0.1 -	0.0 -	0.4 -	0.2 -
Others	8.5 (6)	7.0 (4)	1.4 (2)	2.7 (2)	16.1 (6)	6.4 (4)

From Table 1, it would be quite evident that English is the most dominant language as seen through the coverage of six major secondary publications in six important broad subjects. Next to English, Russian is the second major language, at least in the field of Chemistry, Biology, Physics and Mathematics. German is quite important so far as Engineering and Medicine are concerned.

A comparison of the two estimates brings out some interesting points. Excepting in the CAS data base, English has taken further strides leaving all other languages far beind during the intervening period of about ten years. Russian has improved its position in several data bases and has

also come down in some during the same period. On the whole, the second position is clearly established by Russian as can be seen in Table 1.

For two of the abstracting/indexing periodicals included in Wood's and Ellen's studies, Bottle and Wyatt[8] give a slightly different picture of language distribution. Their figures are given in Table 2.

Table 2

Language-wise distribution of items in the Biological Abstracts and Index Medicus

Language	Biological Abstracts, 1967	Index Medicus, 1967
English	68%	56%
Russian	14	3
German	7	9
French	5	11
Spanish	2	3
Italian	1	6
Polish	1	3
Japanese	1	3
Czech	1	2
Others	1	4

Again, the pattern is almost the same, except that in the coverage of the Index Medicus, Russian has a very low percentage. From more recent estimates of Ellen, as given in Table 1, it would be evident that Russian coverage has gone up considerably and percentages of German and French items have come down.

Bias in the Coverage

It may be mentioned that the analyses presented above are relating to abstracting/indexing services which are all published in the English-speaking world. Their coverage is likely to be affected by a bias in favour of English. However, all of them claim to cover the world literature in their respective subject fields. There are also genuine difficulties in the procurement of foreign language material and preparing abstracts for them. Perhaps, the above analyses give a more close picture of what the scientists and engineers in the English speaking countries consider to be important in the world literature published in various languages.

Language Distribution in more Specific Subjects

The country/language bias can be seen very prominently in another analysis supplied by D N Wood[77] again, based on the coverage of the Bulletin Signaletique (Engineering Section only) of 1972. This is presented in Table 3.

Table 3

Language-wise distribution of Engineering subjects literature (Percentages)

Subject	E	R	G	F	S	I	J	O
Civil Engng	31.8	3.9	15.8	34.2	0.7	3.0	0.4	10
Transport Engng	35.8	9.9	28.3	13.5	0.1	4	2.5	4.8
Aeronautical & Space Engng	65	11.4	10.3	12.4	-	0.7	-	0.2
Biomedical Engng	56	3.1	16.4	19	0.5	1.5	2.2	1.3
Mech Engng	29.2	21.6	23.3	19.6	-	2.2	1.4	2.5
Chem Engng	50.4	16.8	12.4	11.3	0.4	0.5	3.2	5
Electrical & Electronics	40	26.8	16.4	6	0.6	0.9	0.3	8.5

E = English; R = Russian; G = German; F = French; S = Spanish; I = Italian; J = Japanese; O = Others.

Engineering as such is an applied science and hence there is a greater chance of a country/language bias. This is reflected in the high scores for French in almost all branches of Engineering. Although English maintains a lead in most of the branches, it is far below the over-all position of English in Engineering, as a whole, as seen table 1. The ranking of Japanese is surprising, especially in areas like Electrical and Electronic Engineering, and Biomedical Engineering.

The country/language bias is perhaps much more pronounced in the coverage of three important abstracting/indexing periodicals published from three countries with different languages. The figures are given in Table 4.

Table 4

Language-wise distribution of Geology literature, 1977 (Ellen[23])

	Eng	Russ	Ger	French	Jap	Others
Bibliography and Index of Geology (USA)	72	14	2	3	1	8
Bulletin Signaletique Section 220-227 (France)	60	9	8	14	0	9
Referativnyi Zhrunal – Geologiya (USSR)	29	48	5	9	2	7

Language Breakdown of Primary Journals

In this context, let us look at yet another analysis. This time it is the language-wise breakdown of the largest collection of periodicals publication in the world, i.e., the British Library Lending Division (BLLD). It is well known that this library attempts to acquire all important scientific and technical periodicals from all over the world. The language-wise break-up of this collection is as follows[76].

Table 5

Break-up of BLLD Periodicals collection

Language	Percentage	Language	Percentage
English	46	Spanish	3
Russian and other Cyrillic languages	14	Italian	3
		Polish	2
German	10	Czechoslovakian	2
French	9	Portuguese	2
Japanese	4	Other languages	5

Although, similar analysis of current holdings is not available from the BLLD, the following information has been supplied by them. 22% of current serials come from USA, 19% from UK, 5% from USSR, 8% from Germany, 8% from Austria, 2% from Switzerland, 4% from France and 5% from Japan, accounting for 73% of the total intake. There appears to be a slight decrease in the percentage of Russian and other Cyrillic journals.

One may argue that the BLLD collection also may have a bias favouring English. Its collection has been built up mainly on the basis of usefulness of the material and actual demand made on it. Intially, the BLLD almost exclusively catered for the domestic requirements. To that extent the collection had reflected the actual use of scientific literature by British scientists. However, the BLLD has also a mandate to acquire and make available to the British scientists useful materials from other countries in different languages. This bold and pragmatic policy has been largely instrumental in building up a vast collection of more than 55,000 current periodicals on which many individuals, libraries, and information centres fall back as the place of last resort. In fact, any periodical which is considered worthwhile by any group of scientists is likely to be available in this library, irrespective of its country of origin and language. Such is the credibility of this Library.

When considered in the context of the usefulness and credibility that the BLLD collection enjoys, not only in Britain but in other countries also, it should not be very much off the mark to

say that this collection represents quite closely the world literature in science and technology, so far as the most important and voluminous primary documents, i.e. periodicals are concerned.

Heavy Concentration in a Few Major Languages

From the foregoing analyses- based on the language-wise coverage of the major comprehensive abstracting/indexing services and the language break-up of the world's largest collection of periodicals literature, it is quite evident that English occupies the top position in the language table. Even a modest estimate will put it that about 50% of the world literature in science and technology is available in the English language. Similar analyses done even at the beginning of the present century must have given a completely different picture. English was surely not to be found so far ahead of other languages such as, German and French. The position of Russian would have been towards the bottom of the table, while Japanese and Chinese would have hardly found a place in the table. This means, within the present century there has been quite a few major changes, in fact upheavals, in the relative position of the languages as medium of scientific and technical literature. English has gone far ahead of all other languages and has emerged as the most important language of science and technology. Although Russian has very quickly moved up to occupy the second position, yet it has remained far behind English. German and French have gone down to the third and fourth position. Beyond that a number of languages are vying with one another to hold a position. In fact at this level there are many more languages now.

In all the estimates, referred to above, it would be quite evident that the five major languages cover about 82-96% of the total literature, out of which English alone covers from 46-82% of the literature. The point that is being emphasised is that although there are now more than seventy languages in which scientific and technical literature is published, there is also a heavy concentration of literature in a few languages. So far as the concentration in English is concerned, perhaps, such a position has never been enjoyed by any other language after the decline of the Latin as the common language of Western science. English appears to be going to occupy the position of a new lingua franca. In general, an English knowing scientist, then, is in a very advantageous position as he can read directly about 50% of the world literature. This sounds very encouraging. If the same thing is put in a slightly different way, it makes a vast difference. It may also be said that an English speaking scientist is likely to miss as much as 50% of the literature in his own subject because they are available in languages which he is not usually able to read. In other words, he too faces the problem of the language barrier.

Different Angles to Look at the Language Barrier

The questions that arise are – how far is the English speaking community aware of the problem; can they afford to ignore the literature available in other languages; what facilities are available to them to get access to the contents of foreign language material and so on. All these will reveal to us only one aspect of the language barrier. There is another equally important aspect of the whole issue, that is, the nature of the problem as faced by the non-English speaking community. Take, for example, the case of a Russian scientist. The volume of literature available in his own language has increased manifold. At the same time he is made aware that an increasingly larger volume of useful literature is getting published in English and a few other languages which he is not able to follow. The German scientist, on the other hand, faces a slightly different problem. The percentage of literature available in his own language has decreased over the years, but his proficiency with

English language is not as bad as his Russian counterpart. The French speaking community also has almost a similar problem. In other words, the language problem is faced by different language speaking communities in different ways and its intensity felt in varying degrees depending on how important is its own language as a carrier of scientific information, the extent of foreign language proficiency of the members of the community and the translation facilities and other aids available to them. Thus, solutions to the foreign language problem are also likely to be viewed in different ways by different language groups. The developing countries may have problems of their own *vis-a-vis* the language barrier.

Measurement of the Language Barrier

In this context it would be useful to take note of a formula suggested by M Kunicki[49] for the quantitative estimation of the language barrier. The formula is as follows:

$$W = PI\ (1 - U1/U) + P2\ (1 - U2/U) + \ldots\ldots\ Pm\ (1 - Um/U)$$

where W = the index of the level of the language barrier for a reader or group of readers in a specified subject area;

m = the number of languages in which publications relating to the chosen field are written;

PI = the proportion of world literature in the chosen field published in the language I;

U1 = the number of readers in the group knowing language I;

U = number of individuals in the group (for an individual reader U = 1 and U1/U = 1 for each language known and 0 for each language not known

As an example, the case of an English knowing chemist may be taken who knows no foreign languages and is interested in a field for which the publication languages have the same distribution as that of the Chemical Abstracts (as given in Table 1):

P English = 0.47	P Russian = 0.27	P German = 0.09
P Japanese = 0.08	P French = 0.03	P Other languages = 0.06

For this reader, then, the level of the language barrier is calculated at:

$$W = 0.47\ (1-1)+0.53(1-0) = (0.47 \times 0)+(0.53 \times 1) = 0.53$$

53% of the world literature therefore escapes him.

If this same reader could also read Russian, the language barrier level for him would be reduced to

$$W = 0.47(1-1)+0.27(1-1)+0.26(1-0) = 0.26$$

Languages of the Secondary Literature

In the preceding pages various estimates have been presented about the language distribution of primary literature in the field of science and technology. On the basis of them, it is often believed

that English is rapidly ascending to the status of a new lingua franca of science and technology. Hans Wellisch has shown that this is almost entirely true of English as an indexing or retrieval language, in other words as the language of secondary literature. In fact, primary documents are being presented in an increasing number of languages, ranging between 70 and 80, even though nearly half of them are in one language, i.e. English. But in the area of secondary literature the position of English is even stronger. Hans Wellisch supplies the following figures[74]:

Table 6

Languages used by six largest abstracting services in three disciplines

	Biology & Micro-biology		Chemistry		Physics	
	Services	Entries	Services	Entries	Services	Entries
English	2	170,000	3	275,000	2	70,000
French	2	84,000	1	56,000	1	42,000
German	1	35,000	-	--	1	42,000
Japanese	-	--	1	67,000	1	41,000
Russian*	1	180,000	1	100,000	1	45,000

**On the basis of 1963 data*

In the field of Agriculture, a similar picture has been brought out by a survey[54]. Out of the 364 abstracting services available in the field, it was found that English was the most used abstracting language with more than 36%, followed by German with 12% and French and Russian with 11% each.

Discrepancy Between Primary and Secondary Document Languages

Thus, the important point here is the growing discrepancy between the multiplicity of primary document languages and the predominance of one secondary document language. This is likely to have serious implications for those users of information who do not follow English. Abstracting services are usually regarded as access tools. Due to the availability of large volume of current literature in any subject, one cannot scan through all of them directly. Instead, an access tool like an abstracting service is usually used by most information users in selecting only those items which are most relevant. The abstracts are positive help for making such selection. If a language barrier is faced at this point by an information user then even the preliminary access to information is likely to be hampered.

Carrier Language of On-line Data Base

A very much similar situation is developing in another mode of access to scientific information. The application of modern electronic techniques and telecommunication facilities in such fields

as the provision of on-line access to computerised data bases is making the influence of the language barrier daily more apparent. For most of the data bases, especially bibliographic data bases, available on-line, the language of access or the carrier language is English. According to A Iljom an analysis of the survey carried out in 1976 by ASLIB and EUSIDIC of data bases available on-line in Europe, one obtains the following results[41]:

Out of 337 machine-readable bibliographic data bases:

10% only had German as a carrier language
10% only had French as a carrier language
4% were in other languages or were multilingual in some way
76% had English as a carrier language

The number of data bases available on-line has increased since then but the position of English as a carrier language remains predominant. It may be mentioned that in a number of data bases English has been added as an alternative carrier language.

Thus, English has emerged as not only the most important language of secondary literature but also as the predominant carrier language of data bases. Such a development naturally can be viewed from two angles. In the English language world dissemination and access to information has become easier and quicker. For others, who cannot use English either as indexing and retrieval language or as a carrier language, the effect of the language barrier will be more intense and pronounced.

Some Developments in the Languages of Secondary Literature

Although, English appears to have attained the status of the language of secondary literature, there have been developments and realignments in other languages and countries. After the decline of Latin as the common language of scientific communication in Europe, German came very close to taking the place of Latin, in as much as French became the common language of politics and diplomacy. It is no wonder that the first abstracting periodical, the *Pharmaceutische Centralblatt* (subsequently changed to *Chemische Centralblatt*) appeared in German in 1830. Not only that, a host of other bibliographical tools, including the celebrated *Beilstein*, all appeared in German. For quite some time these were the most important secondary publications for all serious workers and all of them were in German. There is evidence to show that all these publications were used by scientists all over the world. It is only in the early part of the present century, in 1907, that the giant abstracting service the *Chemical Abstracts* made its first appearance. Since then, the number of abstracting services in English, in various subject fields, has steadily grown. In some cases they have even eliminated other competitors in some fields and have captured for them the world market, so to say.

During this phase of intense competition among the major secondary publications, the launching of an English language abstracting service, namely the *Excerpta Medica*, from a non-English speaking country has an interesting story behind the venture and is relevant for us. The *Encyclopedia of Information Science and Technology*[24] gives us the following information about the genesis of this service.

"... in 1945 three Dutch physicians, held as hostages in the same internment camp, first discussed the possibility of organizing a comprehensive medical information service which would

screen, evaluate, classify, index, abstract into English, and disseminate the world's biomedical literature. The need was obvious, since except for the German *Zentralblatter* series, the Russian-language *Referativnye Zhurnaly*, a few specialized services sponsored by various governments and scientific societies, the harassed physician and biomedical researcher had no where to turn for guidance in digesting the rising stream of medical information...

Be that as it may, *Excerpta Medica* was created after the war and began in 1947-48 ....

With the advent of Sputnik and the increased interest in non-English scientific literature in the Western world, the financial problems of the Foundation were eased somewhat by grants from the US Government for the abstracting of Soviet and Japanese publications. This was followed during 1961-64 by grants from the US Public Health Service and then from Euratom for the publication of three additional sections..."

From the above excerpts, it becomes clear that the Dutch pioneers very correctly estimated the decline of German as a language of secondary literature and also the rise of English in that role. The decision to publish abstracts in English has also proved to be a commercial success. The starting of an important abstracting service in English in a non-English country and the closure of the German *Chemisches Centralblatt* are two significant events. On the linguistic problems of the *Excerpta Medica*, the author of the Encyclopedia article, Robert R Blanken, further states:

"The linguistic problems encountered by *Excerpta Medica* in its efforts to abstract the world's biomedical literature into English are aggravated by two factors: 1) the location of the editorial office in a small European country where English is not the mother tongue, and 2) the fact that, contrary to popular belief, the use of English in the world scientific community is no longer increasing but reached a peak in 1920, after which its relative importance began to decline due to the increasing use of Spanish, Russian, Japanese, and other languages of the 'third world'. To help solve this problem, *Excerpta Medica* established a translation service which originally concentrated on fulfilling internal needs but now also does translations for third parties... About 70% of the several million words translated annually are translated into English."

Significance of the Success of *Excerpta Medica*

In the above account a number of important points have been touched. The statement that the use of English is no longer increasing will be disputed by some. However, it is certain that among the non-English languages there are now a larger number and some of them have become important media of scientific communication. But they have not much affected the position of English. Their gains have been at the cost of German and French to a certain extent. This is true when English is considered as a language of primary literature. That it has gained in position as the language of secondary literature, even after 1920, is substantiated by the success of the *Excerpta Medica* itself which was conceived in 1945 and started in 1947-48. Another important point to be noted is the fact that about 70% of the translations done for third parties are into English. This shows that the *Excerpta Medica* has succeeded in bringing to the attention of its users large volume of important non-English literature and generate sufficient interest in them to request for full translation.

Rise of Multi-series Abstracting Services in Non-English Countries.

Side by side with the development of English as the most important language of secondary literature there have also been some parallel developments in other language groups and countries.

One such important development has been the growth and rise of a number of multi-series massive abstracting services spanning the whole spectrum of science and technology and covering the world literature in different languages. Prominent examples of such abstracting services are: the *Bulletin Signaletinque* in France, the *Referatinyi Zhurnal* in the Soviet Union, and the *Kagaku Gizyutu Bunken Sokuho* (Current Bibliography on Science and Technology) in Japan. These are the most important access tools to world literature in the respective countries. There is hardly anything comparable with these massive and centralised services like these in the English-language countries. One important aspect of all these services is that they provide comprehensive coverage of the domestic literature and at the same time make a good coverage of the world literature. There has been a persistent complaint from most of the non-English countries that the English language abstracting services in various disciplines do not really cover in full the literature in languages other than English. All the non-English abstracting services, mentioned above, have corrected this position so far as the domestic literature of the respective country is concerned. As all of them, at the same time, bring a selection of the world literature, this selection has to be based according to the national requirements and similar considerations. In all the cases the services are being brought out by some governmental agencies of the respective countries. Taking into account the pattern of the abstracting services of the world literature as a whole, it will be quite obvious that there is considerable amount of duplication of effort. Not only the same items are monitered and processed again and again but the full texts of a large volume of literature have to be read and understood by different groups of abstractors and their abstracts prepared independently in different languages. The other aspect to be taken note of is the practice of selection in the abstracting services which is most often done keeping in view the special requirements of a country or language group. Hence, this practice is likely to present different views of world literature to different groups.

Growth of National Abstracting Services

Incidentally, it may also be mentioned here that due to the alleged partial coverage of the literature of a number of countries, especially some of the developing countries and scientifically less important countries, there has been a growth of national abstracting services. Most of them have appeared after the Second World War. The main objective of these services is to keep a complete record of the scientific achievements and publications of the respective countries. Such services have necessarily to be in the languages of the respective countries.

Which Way will the Data Bases Go?

The above rehash on the developments in the area of abstracting services will surely make one ponder as to whether similar developments are going to take place in the area of data bases also. The difficulties being faced by the Japanese on-line users have been expressed in a paper by Komatsu, Hara and Taska[47]. As has been stated earlier the carrier language of most of the bibliographic data bases available on-line happens to be English at present. This is largely due to the massive investments by producers, vendors and carrier agencies in the United States and also to the general development in computer and telecommunication facilities in that country. If data bases are also going to be created in different languages, with provision for keywords or descriptors and commands for use all in different languages, there will be a tremendous amount of duplication

of effort and wastage of resources. As it happens in similar situations, ultimately the user of information will have to bear the highly inflated cost of these services. This is an area where immediate international collaborative effort is needed. It may be recalled that in the area of computerised proceesing of bibliographic data, already there is some sort of language obstacle being faced because of our use of different record formats, different character sets in the input/output equipment, different search languages, some of which are rigidly oriented towards particular makes of computers and so on. The Unisist Feasibility Report had pointed out the dangers of creating such a new Tower of Babel and suggested remedial measures which have been incorporated under the Unisist programmes for System Interconnections.

What is being emphasied here is that any attempt to create the bibliographic data bases in different languages, even the major languages, will result in a senseless duplication of effort and wastage of resources. At the same time the data bases being produced with so much of investment have to be made accessible and searchable through different languages. This requires a different line of action, some of which are development of suitable interfaces, multi-lingual thesauri, instruction manuals in different languages and so on. These points have been specifically mentioned in a technical paper by the U N Centre of Transnational Corporations[68].

The Language Barrier at two Levels

It may be specifically pointed out that the language barrier is now being faced by information users at two levels. First, at the level of using secondary publications for the location of relevant documents. Secondly, at the time of consulting primary documents, retrieved by using secondary publications. The discrepancy in the use of more number of languages for primary documents and the use of less and less number of languages for secondary literature is going to create more problems for most of the information users or at least they will face the language barrier more often.

Concentration in a Few Languages

All the estimates and analyses presented so far clearly bring out the heavy concentration of scientific and technical literature in a few languages, namely, English, Russian, German, French or Spanish, often called the major languages. At the same time the number of languages in which scientific literature is getting published is increasing. As has been mentioned earlier the pattern has been changing. For the present pattern political factors have contributed much. For example, the spread of the British Empire in all parts of the world has helped English to attain its position. Economic and industrial developments of countries have also helped the languages of some countries to come up as major languages. Scientific and technological progress of countries have also contributed in a similar way. It is hardly possible to think of a country which is not industrially developed, economically weak and without scientific foundation but its language is important. In most of the large areas of the world which are likely to show the greatest industrial development during the next two decades or so, the native languages will probably be used for publications. In this context, C W Hanson[33] had predicted in 1962, "it seems wise to assume that in the long run the number of significant contributions to scientific knowledge by different countries will be roughly proportional to their populations, and that except where populations are very small contributions will normally be published in native languages". This means the present pattern of heavy concentration of scientific literature in a few major languages is likely to change, may be for the worse from the point of view of the language barrier.

THE USE PATTERN OF SCIENTIFIC LITERATURE

In the previous Chapter an indication of the language-wise distribution of the primary literature being generated in the field of science and technology has been given. An idea on the coverage of this literature in abstracting/indexing services and in machine readable data bases has also been given. This is important because in most cases information users locate relevant primary sources of information through the secondary sources. Hence, the language-wise coverage of the secondary services are likely to effect the final use of primary documents.

Further, the availability of large number of primary documents and their proper bibliographical control is one thing but their utilization is another thing. How far the prevailing diversity of languages is acting as a barrier to the fair use of these vast literature, in spite of good bibliographical control, is the more important point in the present context. The actual use of the literature in different languages in different countries and groups have been measured in various ways. One important indicator has been the citation of documents in different languages in relation to the language of the citing document and also the availability of documents in different languages in various subjects. The findings of some relevant studies of this nature are presented here.

National and Language Bias in the Use of Scientific Literature

Looking at the national contributions to the world stock of information, V V Nalimov had collected some useful figures which have been quoted by Leonard Beck[5]. Nalimov's figures are as follows:

a) The USSR provides about 20% of the world's information, somewhat less if biology is weighted
b) The English-language countries provide 40 to 60%, with a median of about 50%
c) The German language groups provide about 5 to 10%
d) The Japanese provide about 5%

However, the actual use of the world literature in different countries has a national bias. This can be seen in the citation practice of authors, specially in self-citation, meaning thereby citation of references from one's own country or from the same language group. The following figures add substance to this, which refer to the percentage of self citation:

United States and Great Britain	68 to 83%
USSR	37 to 65%
West Germany	29 to 36%
France	31 to 35%

It has been said, and the above figures prove it that 'each country lives on its own scientific capital'. Because of the above pattern of citation practice it has been concluded that the USSR on one hand, and the USA and Great Britain on the other, form two distinct information systems living almost exclusively on their inheritance from past writers in their own language. No other country has an information system closed to a comparable degree.

The above was relating to citation of literature of one's own country or language group. Talking about another aspect of the citation practice, the study reports as follows: The citation of

scientists of the USSR in the journals of other countries is rarely more than 5.5% of the total, and most frequently lies between 3 and 4%. The citation of English scientists is usually 50 to 55% of the total number of citations, and so is in good agreement with the English language contribution. The only exception to this generalization occurs in Soviet practice, which cites the Anglo-Americans only 25 to 30% of the time. The Germans are cited 5% of the time, in good agreement with the German effort. The citation frequency of French science is less than 5%, so that, like the Russians, the French are cited less than they write.

The above statistics and explanations would suggest that the scientists in the English language countries and in the Soviet Union, separated as they are by a language barrier, are likely to have completely different views of the same subject. Apart from greater risk of wasteful duplication of effort in the two different language blocks, such a situation is surely deterimental to the smooth progress of science and technology. Fruits of progress also cannot be shared between two peoples separated by the lanauge barrier.

Use of English Language Literature in Various Countries

Looking at more or less the same problem, as considered by Nalimov, but changing slightly the angle of observation, J H d'Olier[19] presents the following view regarding the use of English language literature by different language groups. These figures are again based on citation studies.

Table 7

*Percentages of scientific literature read in English by research workers in various disciplines and language areas**

Language Area	Discipline			
	Geol Sci	Biol Sci	Agri Sci	Med Sci
English-Europe	62-96	68-96	93-97	80-98
English-N. America	86-98	87-98	97-99	96-100
English-Australia	100	93-100	95-100	100
French-Europe	39-41	34-46	27-62	--
German-Europe**	20-22	20-24	22-28	--
Remaining Western Europe***	35-67	32-76	36-87	--
Eastern Eruope****	7-40	8-28	15-17	--
Asia	80-92	78-94	88-94	--

-- = No or insufficient data available

** Highest and lowest percentage found among samples of publications studied*

*** FRG and Austria*

**** Linguistically a mixed group, comprising the five Nordic countries, the Netherlands, Belgium, Spain, Portgual, Italy, Switzerland*

*****Including USSR. The percentages found for the USSR for English, French and German are generally lower than for the rest of Eastern Europe, whereas the percentage for Russian is usually high in the USSR and rather low in the rest of Eastern Europe.*

Comparison of the Two Views

Thus, when the findings of Nalimov and d'Olier are considered together there is considerable evidence to support the earlier hypothesis that each country lives on its own scientific capital. Although the Russian produce about 20% of the world's information and the English language countries produce 40 to 60%, the Russian cite as much as 37 to 65% Russian references and as low as 10 to 28.3% English references (25 to 30% according to Nalimov). At the same time English references are being used in some of the English language countries almost to the exclusion of all other languages.

One notable feature in Table 7 is the very high percentage of use of scientific literature in English in Asia. In this area although a number of languages are in use, for scientific communication English appears to be the common language. There are countries in Asia, such as India, Pakistan, Bangladesh, Sri Lanka and Burma which had historical connection with Britain and modern science and technology was introduced to them through English. There are countries like Japan which have deliberately taken to the English language to accelerate the pace of progress in science and technology and industry. As has been stated elsewhere a sizeable proportion of world scientific literature comes from Japan in Japanese. Even then the Japanese are heavy user of English language scientific literature.

National and Language Bias in a Specific Field

In a more recent study by B A Morgan[54], a similar view is available of the bias in the use of English language literature in the subject of Agricultural Engineering in USA, Canada, and UK. To assess the magnitude of this bias, an estimate of the national levels of publication in the particular subject field was also provided. This was obtained through the coverage of the *Agricultural and Horticultural Engineering Abstracts of 1966*. The national contributions were found to be as follows:

Table 8

National contributions to Agricultural Engineering Literature

Rank	Country	No. of items	Percentage of total
1	USSR	798	39.9
2	UK	250	12.5
3	USA	245	12.2
4	Germany	244	12.2
5	Czechoslovakia	132	6.6
6	Netherlands	87	4.3
7	Italy	52	2.6
8	Australia	46	.....91.3%
9	France	42	2.1
10	Canada	31	1.5
			.....96.2%

One interesting feature is the position of Russia at the top in spite of the usual language bias that an English language abstracting periodical is likely to have. The second interesting point is the almost equal ranking of three countries i.e. U.K., USA, and Germany.

Against the background of national contributions, the citations in three different primary journals published from three English language countries were checked. These three source journals were – the *Transactions of the American Society of Agricultural Engineers (USA), Journal of Agricultural Engineering Research (UK), and Canadian Agricultural Engineering,* and the citations were checked for 1966 and 1974.

The study has shown very clearly that there was a considerable bias in all the three journals examined, towards English language material in general and towards the home product in particular. This was notably so in the case of North American publications. In the *Canadian Agricultural Engineering* for 1974, over 97% of the citations were from the USA, Canada and the UK. In the *Transactions* for both 1966 and 1974 over 95% were from these three countries plus Germany. In the *British Journal of Agricultural Engineering Research* the spread was greater. In both 1966 and 1974 five countries were responsible for 90% of the citations while 95% of citations encompassed eight countries in 1966 and nine in 1974. The most outstanding feature of the results is the extent to which a large amount of Russian literature in this subject is being totally ignored by Anglo-American workers.

Other Ways of Determining the Use of Literature

The results of three studies based on citations have been presented above. As has been said earlier, there are other methods of finding out the use of scientific literature by different language groups. One such method is the analysis of library borrowing records. However, for obvious reasons, such analyses will be very much biased by the nature of the library holdings. If a number of such studies are made, then they may together give a general picture of trend of use of documents. A better method is, naturally, the survey of use of literature by information users. This is a direct method and naturally it has all the advantages and drawbacks of a direct method. It is also a time consuming and costly method. Fortunately, within the last fifteen years, three surveys have been conducted in Britain on various aspects of the language barrier, including the use of foreign language literature particularly in the Sheffield survey[38]. Relevant findings are presented here from this survey as they are likely to be typical of most of the English language countries and groups (Table 9, 10).

Sheffield Survey on the Use of Foreign Language Materials

Records of borrowing from the Sheffield University libraries, during the year 1968; by each individual in the survey population (1439) were analysed by language category. Excluding the departments of Arts and Social Sciences the total number of items borrowed was 16,691 and they were distributed as follows:

1. In all cases of multi-lingual items, English was one of the languages
2. Category E(trE) means journals containing English translations of Russian articles

From table 9 it becomes clear that more than 90% of all borrowings are confined to English language document only. The concentration is more for applied science subjects like Engineering and Medicine. The borrowing records of journals were further analysed and the results are given in table 10.

Table 9

Borrowing from the Library (Percentages)

Faculties	English	Multilingual	French	German	Russian	E(trR)	Others
Engineering	97.61	1.10	0.32	0.70	0.02	0.23	0.02
Materials Tech	91.91	3.30	1.32	2.15	0	1.03	0.20
Pure Sci	92.71	3.38	1.99	1.40	0.06	0.20	0.26
Medicine	95.95	2.67	0.43	0.70	0.03	0	0.22

Table 10

Borrowing of Journals

Type of Journal	No. of borrowed	Percentage
a) Journals with all articles in English	2126	69.80
b) Journals with articles in English and other languages	421	13.82
c) Journals with all articles in French and 75-99% articles in French	153	5.01
d) Journals with all articles in Germand and 75-99% articles in German	133	4.35
e) Journals with all articles in Russian and those containing English translations	116	3.83
f) Journals with 75% or more articles in Japanese	6	0.17
g) All other journals	94	3.02
Total :	3049	100.00

Thus, in the matter of borrowing of journals there is some evidence of use of foreign language material. However, compared to the volume of such material available the use is very meagre.

The Sheffield survey also analysed the citations in all the 1967-68 publications of the academic staff and theses by research students. Almost a similar picture is obtained from this analysis also.

Table 11

Citations in Publications and Theses (Percentages)

Faculties	English	French	German	Russian	E(trR)	Japanese
Engineering	94.07	0.77	3.00	0.36	1.19	0.05
Materials Tech	85.67	2.16	6.48	1.80	2.88	0.50
Pure Science	89.34	2.63	5.83	0.61	0.53	0.77
Medicine	93.63	2.39	3.14	0.05	0.03	0

Interesting points to note are that the same trend of greater dependence on domestic language documents in the applied fields of Engineering and Medicine are observed, and the comparatively higher use of German documents in the Materials Technology and Pure science faculties.

Indication of a Language Barrier

Evidence of the use of foreign language material provided so far indicate that most of the information users face a language problem. Bibliographical tools do bring to the attention of scientists and technologists rich haul of documents in many languages. Bigger libraries also stock with considerable difficulties relevant documents in foreign languages. But the actual use of these material, as revealed through the citations in their works and records of library borrowings, all reveal poor use of foreign language material. Surely, a total view of the behaviour of information users in facing the language barrier needs to be studied.

DIFFERENT ASPECTS OF THE FOREIGN LANGUAGE PROBLEM IN AN ENGLISH LANGUAGE COUNTRY

Introduction

After having considered the language-wise spread of the current literature in science and technology and also the extent of use of this available literature, it would be worthwhile to consider in some detail the different aspects of the foreign language problem from the point of view of the user community. So far, the indications have been that foreign language material are not very widely used. If the information behaviour of a single language group is studied, answers are likely to be available for this poor use of foreign language material. Fortunately, reports of three extensive surveys, carried out in Britain, are available in the literature, which when considered together can throw sufficient light on the behaviour of a large group of English speaking scientists and technologists in the face of foreign language problem. This is being taken up as a typical case study.

The Language Barrier in Britain

Any discussion on language barrier, importance of foreign language, and use of foreign language material by scientists and similar issues, in the English language countries inevitably takes one back to 1957, the Sputnik year. Indeed, the sending up of the first artificial satellite by the Russians in that year was not only a major step forward in space exploration but it also set in motion a number of investigations, new programmes, evaluation of information systems and so on. The English language world, in particular was rudely shaken to believe that science and technology had sufficiently advanced in a non-English language country, which could support and make possible the putting up of the Sputnik in the orbit a reality. It was feared that if immediate steps were not taken the Russians would march far ahead of others. Scientists realised that it was no longer possible to ignore the scientific literature in other languages, specially in Russian. The initial enthusiasm was marked by starting of innumerable courses on 'Russian for scientists' variety, publication of 'scientific Russian' type of books, conference on translation, and procurement of more foreign-language material. All these have made the information users sufficiently aware of the usefulness of foreign language material and also the presence of an inconvenient though not insurmountable language barrier to get access to foreign language material.

Surveys on Foreign Language Problems Faced by Information Users

Various steps have also been taken to help the information seekers get over the language barrier to some extent. One of the important activity now appears to be to have a close watch over the behaviour of information seekers, especially the scientists and technologists, in the face of language barrier. This can be done through various types of studies. Professional associations of librarians, information workers, translators, and various agencies concerned with the provision of scientific and technical information are deeply concerned with such studies and they have sponsored or carried out such studies. Of them, three are of considerable significance as they give us fairly detailed picture of the information behaviour of English speaking scientists in the face of the language barrier. The first study was conducted in 1965 at the National Lending Library for Science and Technology (presently the BLLD) under the direction of D N Wood, which is often referred to as the NLL survey[76]. The second study was conducted at the University of Sheffield, during March 1968 to

December 1969, under the sponsorship of the Office for Scientific and Technical Information and reported in 1971[39]. This survey is referred to as the Sheffield survey. The third survey was again conducted by the BLLD in 1978[23].

The Three Surveys

It would be worthwhile to recall here some of the important findings of these surveys. The NLL survey was conducted by questionnaire method and there were 2355 scientists and 1045 librarians and information officers in the sample. For the Sheffield survey the population selected was the academic staff, research workers and research students in the University of Sheffield numbering 1439 in all. To find out the factors which influence the use of foreign language materials and which of them were more significant a series of half-hour interviews was conducted with a sample of this population (851 i.e. 59%). The BLLD survey was based on 3256 filled-in questionnaires from a random sample of its customers.

Language Ability

One important aspect in all the surveys was to find out the linguistic ability of scientists. The following table gives a comparison of the finding of this ability.

Table 12

Linguistic ability (Percentages)

	French		German		Russian	
	F	D	F	D	F	D
NLL Survey	11.90	51.40	7.70	17.96	0.07	1.09
Sheffield Survey*	15.2	38.77	4.4	10.77	0.65	1.22
BLLD Survey**	12.0	42.9	4.3	12.3	0.8	0.9

F = Fluent; D = Can read with occasional use of dictionary

* *Averages have been calculated after excluding the figures for the Arts and Social Sciences faculties*

** *Averages for all subjects; averages for scientists are less*

It is quite clear that British scientists are able to deal with only two foreign languages, French and German to some extent. In both cases, however, only a small percentage of them are fluent in even these languages. Surprisingly, there is an indication that the language ability of the scientists have decreased during the years. However, Sheffield survey has noted that one reason for the lower figures could be due to the inclusion of more younger scientists (under 30 age group) in the Sheffield population. Nearly 50% of the Sheffield population was in the under 30 age group, whereas in the NLL survey only 20.3% came in this age group. The NLL survey and the BLLD survey had detailed analysis to show that the linguistic ability was better in the higher age groups.

Awareness of the Value of Research in other Countries

One important factor in the use of foreign language material is obviously the awareness of the value of research in other countries. For this reason the Sheffield survey had asked the interviewees to name those countries which they considered to be doing important research currently in their respective specific fields of interest, no limit being placed on the number mentioned. The answers to this interesting question is presented in the following table:

Table 13

*Countries making important contributions in research (Percentages)**

Countries	Faculties				
	Engng	Materials Sci	Pure Sci	Medicine	Total population
USA	86.4	92.4	87.0	97.4	90.8
Gr. Britain	73.4	67.5	74.3	83.6	74.7
Commonwealth	12.8	10.5	16.3	13.6	13.3
France Belgium	25.6	29.5	25.7	31.8	28.25
Germany Austria	36.6	46.5	33.3	35.4	37.95
Italy	3.7	0	5.3	5.5	3.6
Scandinavia Netherlands	16.5	3.8	13.0	37.2	17.6
USSR	38.6	49.5	29.7	9.1	31.7
East Europe	4.6	7.6	5.0	9.1	6.57
Japan	27.6	20.0	13.3	19.1	20.0

** Figures for the Arts and Social Sciences faculties have been excluded.*

A few points need to be specially stressed here. In all the faculties, USA is considered to be the highest contributors to research, followed by Great Britain, the two major English language countries. From the non-English countries Germany/Austria group and USSR ranks alternatively as the third most important contributor. It should be noted that in the faculty of Medicine, USSR is ranked very low and USA gets the highest score. The countries in "East Europe" which were mentioned most often were Poland and Czechoslovakia and among those included in the Commonwealth the most frequently mentioned were Canada, Australia, India and South Africa (very strangely counted as a Commonwealth country in the survey). The low ranking of Japan, as a whole is somewhat surprising in view of the widely acknowledged increasing importance of Japanese science and technology.

Comparing the linguistic ability of British scientists (as revealed in Table 12) with their estimation of the relative contributions of other countries/groups of countries (as revealed in Table 13) one gets a picture of an anachronistic situation. For becoming well informed scientists the right linguistic ability or preference ought to have been German, Russian and French, in that order, but the present preference is clearly French, German and Russian. Incidentally, it may be mentioned that all the three surveys have shown that the members in the Arts faculty or workers in Arts and Humanities have far greater foreign language proficiency than their counterparts in the science faculties, of course with the same preference, i.e. French, German, and Russian. Preference for a second language evidently depends much more on social, cultural, political considerations and educational system of a country than mere information requirements of its people.

In view of the prominence in research attributed to the English-language countries, a further question was asked to the interviewees. They were asked whether they considered all important research was either published in English or appeared very shortly in English. 47.2% of all those interviewed indeed thought that all important research work appeared in English within 4 years of its first publication. The breakdown being 13.5% believed this happened within six months, 13.8% between six months and one year and 19.9% between one and four years. However, in response to another question, it was revealed that about 59% of the research workers have the suspicion that they may be missing important research and the country most likely to be doing important work unknown to them was thought to be Russia. In some of the faculties, it is believed that Japan also is doing much important research unknown in Great Britain. This is a bit surprising because a good proportion of the Japanese scientific literature is published in English.

How Often a Foreign Language Document is Encountered?

The NLL and the BLLD surveys had elicited some important information by asking the respondents whether they had recently come across a paper in a foreign language which they would have liked to read but could not because of the language barrier. As many as 76.8% of the respondents in the NLL survey and 76% in the BLLD survey replied in the affirmative. The figure for scientists and technologists was 81%, for agricultural scientists it was 91%. Out of them 16.5% said that they had experienced this within one week; 47.7% between a week and a month; and 35.8% between a month and a year. On the question of languages of such problem papers, for 38.2% of them the language of the unread paper was Russian; for 32.6% respondents it was German; for 17.5% it was Japanese and for 2.9% cases French. The low scores for French is explained by the fact that more scientists are capable of dealing with literature in French. In the BLLD survey, 34% of the problem papers were found to be in German. Also, there were less number of such paper in Russian and more in Japanese.

Steps taken to Read Foreign Language Documents

In all the three surveys, a set of questions was devoted to the procedures that are followed by scientists and research workers when they have references to articles in languages they cannot deal with. Unfortunately, the steps suggested in all the surveys were not completely compatible. However, some of the common steps are compared in the following Table 14.

The figures given for each step against the three surveys may not be comparable in each case. However, certain trends are quite obvious. Against the first step, the high percentage for Russian is

Table 14

Steps taken to overcome the language barrier (Percentages)

Step taken		French	German	Russian	Japanese
1.	Try to locate an existing translation*				
	NLL survey	23.5	29.4	43	38.2
	BLLD survey	17	15	21	14
2.	Look for English abstract/ summary				
	NLL survey	21.6	31.2	45.3	54.5
	Sheffield survey	26.7	29.8	33.7	52.4
	BLLD survey	30	35	44	46
3.	Get a colleague to outline the contents				
	NLL survey	12.8	33.7	19	4.9
	Sheffield survey	29.8	37.2	16.6	5.4
	BLLD survey	21	27	18	12
4.	Attempt to translate personally				
	NLL survey	67	35.7	5	0.4
	Sheffield survey	70.3	46.1	14	6.5
	BLLD survey	17	16	8	3
5.	Get a translation prepared internally/own organisation				
	NLL survey	21.2	31.3	26.8	11.9
	Sheffield survey**	0	4.8	4.3	13
	BLLD survey	13	13	13	9
6.	Get a translation prepared externally/other organisation				
	NLL survey	8.6	13.2	16.1	27.2
	Sheffield survey	4.6	6.1	6.3	5.9
	BLLD survey	3	4	4	6
7.	Translation prepared by NLL				
	NLL survey	-	-	21.3	-
	BLLD survey	1	2	3	3
8.	Take no further action				
	NLL survey	0.6	0.5	2.4	9.5
	Sheffield survey	9.2	17.3	28	36.2
	BLLD survey	37	28	30	35

* *In the Sheffield survey this step was split into several steps, e.g. 'Look for translation in university library', 'Obtain translation by inter-library loan'.*

** *In the case of the Sheffield survey this means getting the items translated within the university. The higher percentage for Japanese is explained by the presence of a Centre for Japanese Studies in the University, which is willing to assist scientists with Japanese.*

is an indication that most scientists are aware that there is a greater liklihood of locating a translation of a Russian document than from other languages. In the second step, i.e. looking for English abstract/summary, the results of all the surveys indicate that more people depend on this in direct proportion of the difficulty of the source language. In other words, the language being difficult more people are prepared to settle for an English abstract rather than a full-length translation. This can be explained in another way also. Since the language is difficult it becomes more important to make sure that the document is really relevant and for that it is necessary to read an English abstract. In this context, it may be mentioned that the Sheffiled survey found out that 51% of the respondents thought English abstracts/summaries of foreign language papers were useful in assessing their importance, while 28.3% said they were of no use in this respect.

Lack of Awareness About Translation Services and Tools

The low percentages in the sixth step-get a translation prepared externally – is rather surprising. All the surveys have pointed out that many research workers are unaware of the translation services in general. The Sheffield survey report mentioned that only a small minority had heard about the Russian translation service by NLL (now BLLD). A general lack of awareness about the various guides and indexes available, such as Technical Translations, NLL Translations Bulletin, and World Transindex for location of translations was also observed in all the surveys. In the Sheffield survey, 91.2% had never used any of them and 12.6% admitted that they had never heard of their existence. According to the BLLD survey only 11% were aware of World Transindex. Specialized indexes where they existed, e.g. the lists of translation in the *Journal of the Iron and Steel Institute*, had been for more frequently consulted – no doubt because they appear in a journal read for other purposes.

Recommendations of the Surveys

All the surveys had shown conclusively the under-utilization of foreign language materials by British scientists and research workers, which is surely detrimental to research activity. This under-utilization is attributable to a variety of factors constituting a 'language barrier'. Some of the recommendations to ensure better utilization of work published in foreign languages are worth noting.

1. Improved facilities should be made available to university teachers and others engaged in research activity to learn at the outset of their research careers the languages important to their specializations. Such facilities should be provided in preference to teaching foreign languages at the undergraduate level where the motivation is much weaker.

2. Financial support for research should always include an element to cover the cost of full translations of essential foreign language materials.

3. Universities should set up central translation services for the provision on demand of brief oral translations outlining the contents of papers, preferably by linguists in the presence of research workers. Such a service could be part of the library's responsibility.

4. More German and Japanese journals should be translated cover-to-cover or selectively. In view of the importance of Japanese scientific literature and the fact so few British scientists

can cope with this language, the establishment of a centralized Japanese translation programme should be considered.

5. The possibility of providing English translations of article titles in current awareness publications, such as "Current Contents", for other languages, in addition to Russian, should be investigated seriously.

6. Librarians must accept responsibility for disseminating information about published guides and indexes to translations and should increase research workers' awareness of such services and should make access to foreign language publications and translations as easy as possible.

7. Abstracting and indexing services should consider the provision of more comprehensive English abstracts of foreign language material. They should also consider whether the coverage given to foreign language material is extensive enough.

Finally, it may be stressed that the most important step towards surmounting the language barrier is to accept the presence of the barrier and know about its nature. To that extent the three surveys discussed here are of immense value. One can only wish for more surveys of this nature in different places and in different linguistic groups.

Importers of Information

Like all other information problems, the foreign language problem also is likely to pose special difficulties so far as the developing countries are concerned. After all, this problem is in essence getting useful information across another barrier, and this time it is the barrier of languages. In general, most of the developing countries have their own languages and they are different from the major languages of modern science and technology. These countries are not necessarily culturally backward. They are only technologically backward. To come up to a level of reasonable development and ensure food, shelter and employment to the multitudes, these countries have to accelerate their rate of growth. In many cases, even the natural resources have not been fully explored and properly utilized. To achieve all these most of these countries have to purchase, borrow, or adapt technologies from the advanced countries. Development of indigenous science and technology is also necessary even to accept and assimilate foreign technologies. All these efforts ultimately mean use of scientific and technical information which are being generated in advanced countries. In fact, most of the developing countries are heavy importers of information, which is not apparent at times. The logic of the situation for them is quite simple and straight forward. If it is decided to get away from the role of mere exporters of raw materials to foreign industries and instead become economically self-reliant, heavy import of technology and information have to be accepted, at least in the initial stages of growth.

Difficulties of Foreign Exchange

There is yet another important aspect in the use of information by the developing countries. Most of the scientific research activities and the supporting library and information facilities are usually financed by the State. This means finances are always scarce for such activities, as money has to be raised through taxation for which there are severe limitations. Many of these countries, excepting the oil-rich, also have serious foreign exchange difficulties. The cumulative effect of all these is that science and technology, library and information and related activities have always a low priority. Access to information is naturally on a limited scale in such an environment. Intake of information sources, such as books, periodicals, reports, data bases, into the country has to be highly selective.

Developing Countries Having Favoured Languages

The problems of the developing countries can best be appreciated in the context of the preceeding general background. When acquisition of sources of information has to be very selective, it is but natural that only those items which have immediate relevance and which are in a language that is followed by most of the users will only be acquired. This favoured language is usually not the native language of the developing country. As is well known, many of the developing countries are linked with one or the other major languages of Europe. This has happened due to historical reasons. These languages were originally introduced by the colonial masters, mainly for administrative convenience. However, even after the withdrawal of the masters, the same languages have continued to be used in these countries, especially for higher studies and in the pursuit of scientific research. The very

prominent case of the group of countries in the Indian sub-continent can be taken as an example of this trend. India, Pakistan, Bangladesh, Sri Lanka and Burma were all under British domination for nearly two centuries and none of the countries has been able to discard the language even after more than thirty five years of attainment of freedom. The same trend can be seen in a number of countries in Africa and other places. The old saying that 'the sun never sets on the British Empire' although true at one time did smack of arrogance and disrespect to some. Moreover, the Empire has disintegreted. Instead it would be better to say now 'the sun never sets on the English speaking countries' which is more respectable and acceptable to all. One unique feature of the large family of these nations which is known as the Commonwealth, is that there is no language barrier between the members. In any meeting of its members, be it political, cultural, or scientific, there is no need for provision of translation facilities, interpretation or similar interfaces. English is their common language.

The Indian Scene: Background

The preceding elaboration was necessary to emphasise the point that in the case of many developing countries, happily, there is no language obstacle for at least one major language of science. In other words, at least one of the major or dominant languages of science is followed and understood in most of the countries. To have a closer view of production, dissemination and use of information in such countries, let a few examples be presented from the Indian scene as case studies. As has been stated earlier, English continues to be the language of science and higher studies in the country. In the case of India the retention of this language is more necessary as a neutral language in the face of a multiplicity of local languages.

So far as book production is concerned, since independence, the number of titles published has been increasing, The number of titles in the field of science and technology has also been increasing. However, the *Indian National Bibliography* clearly reveals that a large proportion of these titles are school and college level text books, cheaper editions of established foreign text books, translation of foreign books, and popular science books in Indian languages. Advanced level original treatises are very few and those are available mainly in English.

There are more than 1500 current scientific and technical journals being published in India. Most of these are also in English. Out of the few titles which are in Hindi or other Indian languages, many are in the nature of popular science journals or are brought out by local science societies and clubs to encourage Indian scientists, specially the younger scientists, to write in the local languages. In this process, these journals are helping in the useful work of evolving the necessary scientific terminology in the local languages. In fact most of the Indian languages are not yet equipped to record and disseminate modern scientific information. Since the beginning of the present century there have been talks of some form of bibliographical control of the journal literature published in India and there have been some efforts also. Finally, this work was taken up by the country's national documentation centre, the INSDOC (Indian National Scientific Documentation Centre) in 1965. INSDOC has been publishing the *Indian Science Abstracts* since then. This national abstracting service takes care of journal articles, conference papers, patents, standards, and some volume of university theses. What is most important in the present context is that the abstracts in this service are presented in English. The choice of this language is quite natural. This is the only language

through which the scientific work done in India could be disseminated to the scientific community both in India and abroad.

Dependence on Foreign Sources of Information

The above reveals only a part, perhaps, a small part of the scientific literature used by the Indian scientists. The more important part comes from other countries. The stock of any research library, especially the stock of periodicals, can reveal more clearly the sources of information used. INSDOC brought out a publication entitled *Union List of Current Scientific Serials in India* in 1982. This list records 13,403 titles that were being currently received by as many as 785 major academic, research, and special libraries in the country. This includes 1892 Indian titles. The remaining 11,511 titles are being received from as many as 82 countries. Country-wise breakdown of the serials, taking only the first fourteen major countries, contributing up to nearly 1% is given in Table 15.

Table 15

Country-wise breakdown of serials received in Indian libraries

	Country	No. of serials	Percentage
1	USA	3816	28.47
2	UK	2071	15.45
3	India	1892	14.12
4	Germany (FRG & GDR)	693	5.17
5	USSR	621	4.63
6	Japan	539	4.02
7	Netherlands	438	3.27
8	France	405	3.02
9	Australia	291	2.17
10	Switzerland	255	1.90
11	Canada	253	1.89
12	Italy	163	1.22
13	Poland	142	1.06
14	Czechoslovakia	129	0.96
15	International Organisations	125	0.93
	Others	1570	11.72
	Total	13,403	100

The above table brings out very prominently a number of points that have been discussed earlier. Firstly, the total number of titles taken within the country by the 785 major libraries must be considered very low by any standard. It may be recalled that the BLLD alone is getting 55,000

titles in its collection. This shows how seriously restricted is the Indian scientists' access to the world literature.

As can be anticipated in a situation suggested by the above figures, there is likely to be heavy duplication of titles in the holdings of the different libraries. In fact, a rough analysis of the *Union List* shows that between 785 libraries, as many as 881 titles are being received by 20-50 libraries, 289 titles by 51-100 libraries, 20 titles by 101-150 libraries, and 5 titles by 150 and more libraries. Duplication is necessary and inevitable to a certain extent. However, lack of coordination and absence of any effective plan of resources sharing is responsible for much of the duplication. It appears the libraries of the affluent countries are much more conscious of the benefits of resource sharing than their counterparts in the developing countries. This is indeed a paradoxical situation. The result is that all of them try to be self-sufficient. As that is not possible by any one of them, they fritter away the limited resources in needless and avoidable duplication. The net result is that the country as a whole has to live up with a very poor collection. This is exactly what the analysis of the *Union List* indicates.

Dependence on English Language Periodicals

Coming back to the foregoing table, giving a country-wise breakdown of the intake of serials, it would be evident that serials from the first three countries, viz. USA, UK and India account for as much as 58.04% of the total intake. Excepting a few titles from India which are in the local languages, almost all of them are in the English language. When we add to this the English language serials from Australia, Canada and a few other countries, and also quite a few from Netherlands, Switzerland and from a few other countries and add to them the serials from the international organisations, it may be safely estimated that the intake of English language serials would be more than 75% of the total. It may also be added that from Western Europe there are now a number of periodicals which are multilingual and English is one of the accepted languages in almost all such cases.

The position of Russian serials in the table also needs some explanation. The apparent suggestion that 3.63% of all reading material of the Indian scientists is supplied by Russian periodicals is quite optimistic. It is true that these periodicals, 621 titles, are being received in the country but most of them are available in one library only – the National Science Library at INSDOC. They are received through a bilateral exchange arrangement, about which more information is available elsewhere. The actual use of this material is not very encouraging. Citation studies done from time to time, taking Indian scientific journals as source journals and also of university theses, all reveal very limited reading of our scientists and very low use of foreign language material.

National Survey of Translation Needs of India

Although the need for scientific and technical translation has been recognised in India and its importance repeatedly mentioned in different forums, no serious attempt has been made to gather sufficient data for the better planning of this activity at the national level. To fill up this gap, the Department of Science and Technology (DST), under its National Information System for Science and Technology (NISSAT) programmes, in collaboration with the Indian Scientific Translators Association conducted a survey[55] in 1982. The objectives of the survey were to assess:

i) the present and future scientific and technical translation requirements,

ii) the possibilities of export of translation products,

iii) the available translation potential in the country, and

iv) translators' training programmes.

The survey was conducted through a set of questionnaires designed to elicit information on the above objectives. Since the response rate was poor (about 15%), it can be taken more as a sample survey. However, response was received from all the five categories of institutions which were approached. They were, government departments and public sector undertakings, private industry and trade, universities and institutes of technology, and research institutions.

Nature of Demand

The overall data indicate that translation requirement is mainly from German, Russian, French and Japanese languages into English. There is also some demand from Arabic, Swedish, Spanish, Italian, Polish, Hungarian, Danish, Chinese, Norwegian, Czech, Romanian, Dutch, Finnish, Portuguese, Serbo-Crotian and Bulgarian languages into English. There is some demand for translation from English into Arabic, Spanish, French and German, particularly from marketing and consultation agencies. This is a comparatively new trend. The responses have indicated that there is going to be an increase of nearly 60% in the translation requirement over the next five years.

Location of Foreign Language Document

On a question of method of location of useful documents in foreign languages the distribution of responses was as follows:

a.	From citations	89.5%
b.	From secondary periodicals	41.9%
c.	Conference participation	37.1%
d.	Personal communication	25.7%

It may be noted that translation indexes and bulletins, though only a few in number, are hardly used in the location of translations.

Agencies for Translation

On the existing translation facilities, the survey reveals five distinct types. These types and their percentage of utilization were found to be as under:

i) In-house staff translators (10.96%),
ii) Panel translators (3.58%),
iii) Centralised translation service of Insdoc (20.30%),
iv) In-house non-professional translators (20.99%), and
v) Ad-hoc external translation arrangements (42.17%).

Government departments and public sector undertakings, where translation work exists, usually maintain staff translators and also utilise the services of panel translators, whenever necessary. On the other hand, most private industries and trade organisations, universities, and institutes of technology depend on the services of the centralised translation service provided by INSDOC. It may be

mentioned that INSDOC, in turn, employes staff translators and also makes use of panel translators. In the fourth type comes those organisations which find it convenient to utilise their own in-house non-professional translation potential such technical staff, engineers, scientists, etc. conversant with foreign languages. For example, one large aeronautical agency in the public sector stated, "... About 30 engineers in regular employment who are trained in Russian language carry out the translation". There are a number of similar cases. Some organisations have also reported that foreign language classes are conducted for their employees. A large percentage of translation requirements are met through ad-hoc external translation arrangements. The external agencies are usually consulates, trade missions, and cultural centres of various countries located in India, and also individual translators. It should be obvious that the services of such agencies are likely to be used for the translation of papers/documents relating to trade, participation in trade fairs, trade agreements, advertisements, etc. These translations are very often not of strictly scientific nature. If it is accepted that only the first three types are regular translation facilities, then only 36.84% of the agencies can be said to have shown sufficient interest in organising their translation requirements. The remaining 63.16% of agencies still prefer to depend on ad-hoc solutions of their translation requirements. It may also be noted that purely commercial translation agencies, as can be found in some of the developed countries, are yet to make a mark in India. Such a venture does not appear to be commercially viable at the moment.

Problems Faced by Users of Translation

Most of the users of translation services have three main problems. They are- delay in getting a document translated, high rates of translation, and quality of translation. These are also inter-related. Some organisations have reported that they are willing to pay more provided the lead time is reduced and quality translations are ensured. A large number of scientists feel that translation of foreign language articles should be available at cheaper rates so that individuals could also get the benefit of this valuable service.

Availability of Translators

The survey has revealed that, except in Russian, there is a shortage of skilled manpower for scientific translation in the country. The shortage is very acute in Japanese and some of the less used languages. At the same time, the translation potential in the country, in the form of panel translators, appears to be under-utilized. Many respondents have indicated their capability to undertake work in respective languages but they have either not done translation work or their service are under utilized.

Other Findings

A few more relevant findings of the survey may also be mentioned here. The annual average output of a full-time translator (for Russian, German, French) is 1000 pages (one page containing 300 words of the English translated text) while for a part-time translator it is 500, 190 and 230 pages respectively. In the case of Japanese language the average output of a full time translator is 500 pages. The majority of the panel translators have complained of the extremely low rates paid at present for scientific translation work. An overwhelming majority of universities, other organisations and translators have expressed the opinion that better and more training programmes for foreign language translators/interpreters are necessary for meeting the shortage of trained translators and interpreters. One important requirements that emerged from the survey was regarding

setting up a national terminology bank. Its main functions would be to identify and channelise the procurement of dictionaries and glossaries necessary for scientific and technical translation in India and collect and disseminate the latest terminology in various languages not yet included in the dictionaries/glossaries.

Other Aspects of the Indian Translation Scene

The Indian survey results may not give as comprehensive a picture as its counterparts in Britain. Even then some interesting points have come up. Along with the salient findings of the survey, some other aspects of the translation problem may be added to get a complete view of the scene.

Since the inception of INSDOC in 1952, translation of scientific documents on request has been one of its most important services. The demand on this service has been steadily increasing over the years. The following table provides an idea of the demand for this service.

Table 16

Translations Supplied by INSDOC

Year	No. of translations	Languages from (only top 4) percentage
1953-54	121	German 33.4; French 27.9 Russian 14.3; Japanese 8.1
1955-56	456	German 37; French 21.7 Russian 14.2; Japanese 11.6
1960-61	554	German 34; French 20.7 Russian 20.2; Japanese 9.1
1965-66	837	German 35.7; Russian 31.6 French 21.7; Japanese 5.7
1970-71	785	German 33.8; Russian 23.4 French 23.4; Spanish 4.9
1975-76	927	German 34.5; Russian 19.6 French 19.6; Japanese 4.7
1980-81	1584	German 29.9; Russian 19.9 French 16.4; Japanese 16
1982-83	1015	German 25.9; Russian 20.1 Japanese 15.2 French 13.0

Thus, it is evident that German, Russian, French and Japanese languages have been accounting for the heaviest demand for translation. This appears to be the general pattern in all English language countries.

One important aspect of INSDOC translation service is that a good percentage of the translations made are done by scientists and technologists who have acquired some foreign language

proficiency and are willing to undertake translation work in their spare time for the benefit of others. INSDOC maintains a panel of such translators. A complete spread of the languages of translations, and number of translations made by INSDOC staff translators and panel translators during 1982-83, are given in the following table.

Table 17

Analysis of Translations Supplied during 1982-83

Languages from	No. of translations done		Total
	By staff	By panel	
German	161	103	264
Russian	111	90	201
Japanese	2	156	158
French	89	42	131
Polish	11	60	71
Czech.	-	30	30
Hungarian	-	23	23
Italian	1	25	26
Dutch	-	14	14
Spanish	2	32	34
Swedish	-	8	8
Romanian	-	15	15
Serbo-Croatian	6	5	11
Portuguese	-	7	7
Chinese	7	1	7
Bulgarian	5	-	5
Danish	-	8	8
Ukranian	1	-	1
Total	396	619	1,015

It may be seen from the table that the efforts of the Insdoc's staff translators have been concentrated mainly on the three major languages, namely German, Russian and French and a few other languages. So far as Japanese is concerned most of the translations have been done by the panel translators. On the whole more number of translations have been done by panel translators than by staff translators. It may, however, be added that the translations that are done by panel members are generally edited by staff translators. This system of getting translations done by part-time translators is a good way of utilizing an expertise available within the country which otherwise would remain unutilised. The panel translators usually are paid more than what INSDOC realises from the customers.

Along with INSDOC's translation service, a number of bigger scientific institutions in the country, where demand for translation is more, have organised their own in-house translation units.

In such a situation there is likely to be avoidable and wasteful duplication of effort. A need has also been felt for a mechanism through which the translations that are being done within the country could be announced and demand for them generated. To serve both the purposes, INSDOC has been bringing out the *National Index of Translations* (NIT) since 1981. The NIT is published monthly and lists the translations prepared by 26 collaborating institutions in India, including INSDOC. These lists are also forwarded to the ITC for incorporation in the World Transindex. An analysis of the NIT for three years, 1981-1983, given in Table 18 will give an idea about the volume and spread of translations in relation to the source language and types of documents.

A glance at the table reveals that translations are being done from more than twenty languages. However, there is a heavy concentration again on four languages, namely German, Russian, French and Japanese. Another important aspect is that apart from articles in periodicals, a large number of patents and standards in these languages are being translated within the country. Largest number of standards have been translated from Russian.

Apart from the facilities for getting foreign language documents translated on demand, as mentioned above, there are certain other facilities created for the acquisition and supply of foreign language documents and also methods for the dissemination of information relating to these documents. The foremost amongst these facilities is the Russian Science Information Centre (RSIC) located in INSDOC. The RSIC is in operation since 1971 in terms of a protocol entered into under the Agreement on Scientific Cooperation between the governments of India and USSR. Two publications are brought out to acquaint the Indian scientists with the publications that are being received at the Centre. One is the *Russian Scientific and Technical Books – An Accession List.* This bi-monthly publication features in transliterated form the bibliographical details of Russian books received with the titles translated into English. The idea is to generate demand for the publications or translations of them. The other publication is the Contents List of Soviet Scientific Periodicals (monthly) which reproduces the English contents pages of about 80 selected Russian periodicals out of about 700 such periodicals being currently received in INSDOC.

INSDOC has also started a quarterly periodical in two series, which carries English digests of selected articles published in several Russian current periodicals. The series are the *Natural Resources Survey and Exploration* (Vasundhara) and the *Agricultural Science* (Kalpataru). Each issue contains about 30 digests.

Regarding published translations of cover-to-cover and selective translations variety, it may be mentioned that the major Indian libraries together are receiving 181 titles of such variety, mainly from Russian into English. Out of them INSDOC alone receives 148 titles. This is not bad when we compare it with BLLD's collection, where 225 such translated journals are available.

About the actual use of the foreign language material and the translated material mentioned above, very little is known. One indirect evidence is provided by the fact that the publications of the RSIC, the digests periodicals, and the National Index of Translations are even now being distributed free of cost. Efforts have failed so far, by INSDOC, to enroll adequate of subscribers.

Another important aspect of the Indian translation scene is that an organised private translation industry is yet to develop, Translation rates are comparatively cheaper for most of the languages. The Indian Translation Survey did explore the possibility of exporting translations or translation products from India.

Table 18

Analysis of Entries in the NIT

S. No.	Source Language	YEAR														
		1981					1982					1983 (upto October 1983)				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1.	Austrian	-	-	-	-	-	-	-	-	1	1	-	3	-	-	3
2.	Bulgarian	4	-	7	1	12	5	-	1	1	7	3	-	6	-	9
3.	Chinese	1	-	-	1	2	4	-	-	-	4	4	-	-	-	4
4.	Czech.	22	12	14	1	49	12	3	5	2	22	15	7	12	1	35
5.	Danish	1	-	-	-	1	-	2	-	1	3	1	4	-	-	5
6.	Dutch	2	3	1	2	8	8	14	-	3	25	3	9	-	-	12
7.	French	198	36	3	152	389	112	26	2	49	189	131	46	9	53	239
8.	German	643	96	34	177	950	332	81	7	47	467	558	102	19	50	729
9.	Hungarian	19	1	3	1	24	13	4	3	-	20	10	2	-	-	12
10.	Italian	19	1	2	16	38	29	3	-	2	34	30	2	-	2	34
11.	Japanese	129	123	11	38	301	95	66	5	15	181	138	81	20	5	244
12.	Korean	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
13.	Norwegian	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-
14.	Polish	46	10	3	5	64	41	8	6	4	59	30	7	-	-	37
15.	Portuguese	17	1	-	4	22	6	-	-	3	9	5	-	-	1	6
16.	Romanian	9	2	1	1	13	7	1	1	-	9	8	4	4	-	16
17.	Russian	381	20	240	130	771	225	8	1676	30	1939	230	19	628	27	904
18.	Serbo-Croatian	2	-	-	-	2	5	-	3	-	8	9	-	-	-	9
19.	Slovak	1	1	-	-	2	2	-	-	1	3	6	-	2	-	8
20.	Spanish	8	-	4	5	17	4	1	-	5	10	29	2	-	6	37
21.	Swedish	5	-	3	1	9	1	-	1	7	9	1	2	1	2	6
22.	Ukranian	2	-	-	-	2	2	-	-	-	2	1	-	-	-	1
23.	No mention language	2	-	-	7	9	-	-	-	-	-	-	-	-	-	-
		1513	306	328	542	2689	903	218	1710	171	3002	1212	290	703	147	2352

Legends

1 = Articles from Periodicals

2 = Patents

3 = Standars

4 = Others (includes thesis, conference papers, books, technical pamphlets, reports etc.)

5 = Total

However, the continued use of a foreign language for the study of science and technology has in some ways affected, even distorted, the growth of science and technology in many of the developing countries. Analysing this problem in the Indian context, A Rahman[58] states the following–

- English as language of science linked the indigenous development, during the colonial period, with that of England, rather than needs of the country in contrast to what had happened, as for example in Japan.
- And the language barrier also deprived the scientists and technologists of the country from the knowledge of earlier tradition, further isolated from the artisans and craftsmen and from the needs of the people.
- The use of English as a medium of science and technology effected the dissemination of scientific ideas and technological knowledge and practices to change the ethos and development of society.
- The continuation of English language as a medium of communication in science and technology has continued the isolation of scientists and technologists from people and is responsible for their linkages with European science even after Independence. The latter to such an extent that even ideas of rural development and use of specific technologies in rural setting seen to originate from Europe.

The above analysis clearly points out the evil effects of excessive dependence on a foreign language. This is true not only in the Indian context but also in the context of most of the developing countries. The more these things are realised, the more intense the demand for the use of native languages will become.

Eagerness to disseminate and the necessity to get access to information

As is well known a scientist is usually a producer as well as a consumer of information. In this dual role, in the information transfer chain, he has to react appropriately when he is faced with an actual or probable language barrier. As a producer and disseminator of information he is interested to reach out to as many people as can make use of the information, recognise the value of the information, make comments or utilize it in any other manner. Naturally, he will be looking for a medium which will ensure him such a large audience or readership. If the medium chosen is a particular periodical, the scientist knows about the standing of the periodical in the subject area and its reputation among the subject specialists. However, very few authors are in a position to choose a periodical on the basis of its language also i.e., a language that will ensure for his contribution the largest and most knowledgeable audience. This is because only a few authors have the necessary language proficiency to express and present their ideas equally well in two or more languages. Hence, for most authors the choice of the periodical has to be within the group of periodicals available in a particular language. Very often this group of periodicals is in the language of one's own country. In whatever way the medium for dissemination is selected either by deliberate choice or by force of circumstances, the net effect is that a portion of the potential audience is automatically cut off. This is so natural and obvious that it is hardly taken notice of, just as we are hardly ever conscious of the fact that when our part of the world is under bright sunshine the other half of the world is in darkness. Even if it is difficult for some to conceive such a thing, our school level science is good enough to prove that this is true.

The Language Strategy

It is quite likely that as a result of our discussions and deliberations on the language barrier over the last few decades, authors belonging to various language groups, especially those in the minor language groups, are getting more and more conscious of the necessity for a change in strategy in the matter of dissemination of results of research, study and observation - the need for a new language strategy, so to say.

Various citation studies have also indicated the necessity of such a change. A study by M. Kunicki[49] confirms that a Polish author publishing in English, French, German or Russian is cited respectively 50,42,37 or 26 times more than an author publishing in Polish. The extent of readership and the choice of the language of communication are also determined to a certain extent by a study of Jagodzinski and Latour. The study points out that, i) in the 'advanced' modern disciplines, such as genetics and biochemistry, authors from non-English speaking countries publish primarily in English, ii) while in more traditional disciplines; such as medicine, and in technology, authors publish more readily in their mother tongue. The desired change in language strategy can only be an individual reaction rather than a group reaction. The language of communication of a group cannot be changed overnight by any official fiat. It is intimately attached with the culture, tradition, aspirations, and history of a group. Individuals, on the other hand, can learn a foreign language provided he is prepared to devote some time and effort for it. In fact there is always some amount of thrill, apart from advantages, in learning a foreign language. The following is a popular exposition of the advantages that one can gain by learning a foreign language, taken from the World Book (1975).

- By learning another language, you gain knowledge of the customs and ways of life of other nations
- A foreign language can help add to your knowledge of your own language
- Learning a foreign language increases your range of communication
- Learning a foreign language helps you add to your general stock of information
- Knowledge of foreign language can help you gain a spirit of broad human tolerance.

The benefits so thoughtfully enumerated above are surely worth acquiring in the present day world when more people are talking and dreaming of a strife-free one world. It has been further stated that learning a foreign language actually involves four distinct skills: 1) speaking, (2) understanding, (3) reading and (4) writing. For a scientist or research worker, perhaps, the two most important skills are understanding and reading, in information use. In fact most information users who learn a foreign language give more emphasis on these two skills. Incidentally, the World Book has included this article (foreign language, learning) for the first time in its 1975 edition, which in itself is an indication of the growing awareness of the presence of a language barrier and eagerness to get over it.

The Case of Japan

Coming back to the question of changing the language strategy and possible group reaction, it has been stated earlier that the language of communication of a group cannot be changed easily. There is, at least, one interesting example of such an effort and its consequences, in recent years. Japan, when it was well towards the road of rapid industrialisation and progress in science and technology, especially after the Second World War, it was realised by the then Japanese government that the country needed more information from outside and also the scientific research output in the country needed to be disseminated to the outside world in a better manner. One of the important steps taken to realise these dual objecties was to encourage the Japanese scientists and technologists to learn English and publish their contributions in English. A number of new English language periodicals were started, mostly by scientific and technical societies. To sustain these new periodicals, the government was providing subsidies (62). Of course, it has to be granted, that the new political alignment of Japan had much to contribute towards such a decision at the highest level. However, that is a separate issue and can be kept out of view for our purpose here. Subsequent reports indicate that the move was not completely successful. As for example, J Michel reports (52) that in Japan the number of scientific and technical journals has grown from 1675 in 1957 to 4929 in 1967, but in the same period the percentage of serials using languages other than Japanese has decreased from 51% to 30%. Even if it is granted that there were no serious casualities among the English journals that were started with official subsidy, the above figures clearly indicate that there were only a few additions of new titles in English. Thus, the experiment was not completely successful. However, it has to be admitted that this is also a loss for the information users outside Japan.

The Case of India

In this context, it may be pointed out that the use of the English language in India presents a completely different picture than what obtains in Japan. This language is now so firmly rooted that it is used not only for scientific communication but for all serious activities. It is also the common language of the educated class whose mother tongues are different. Even after more than thirty six years of independence it is very much used in the administration. For obvious reasons there is some demand to switch over to Hindi in phases. For this the governmental agencies have to offer incentives, by way of increments, cash rewards, etc. to their employees to learn and use Hindi in administrative

jobs. The State governments are also encouraging its employees in the same manner for the use of the respective state languages. So far as scientific and technical communication is concerned, English is almost the sole language. Most of the doemstic periodicals are published in English. Since independence (1947) a number of periodicals in Indian languages have appeared but very few of them have been able to attract quality contributions. As a result some of them have remained at the level of popular science journals and others have, at best, provided an opportunity to some scientists to try and get used to writing in their mother tongues. The major portion of Indian contributions and also the best contributions continue to be presented in English and get published in British and US periodicals. The secondary publication, *Indian Science Abstracts* is also published in English.

More Emphasis as Users of Information

As has been stated earlier, a scientist is a producer as well as consumer of information. As a consumer or user of information he is interested to get access to all important and relevant sources of information. A language barrier can create serious obstacles in getting access to sources of information. Individual reaction in such a situation is, again, to learn foreign languages. The level of language proficiency in the role of an information user is substantially different from that of an information producer. For any individual to write an article in a foreign language, usually a second language, or to present the same theme orally before an audience is far more difficult than read a paper in the same foreign language and understand at least the main points in it. Hence, scientists and engineers learn a foreign language, more often, to become better users of information than producers of information. For providing better and richer information across the language barrier several group reactions and activities are also possible. They are usually in the form of translated or transliterated citations, translated abstracts, digests, reviews and finally cover-to-cover translated journals and ad hoc translations. All these are going to be discussed in some detail in this chapter.

It is believed in some quarters that excepting the provision of single translations or cover-to-cover journals all other methods only lead the user to potential sources of information and cannot reveal the actual information. In other words they bring the user face to face with the language barrier but cannot help him get across the barrier. This ultimately leads to frustration only.

How People come to know about foreign language Documents?

Some of the descriptions in the previous chapters may give an impression that most of the scientists and technologists are linguistically isolated. This, of course, is the impression that one gets from the point of view of the English speaking scientists and technologists. English is the major language of scientific communication, but English speaking scientists appear to have the poorest linguistic ability so far as other languages are concerned. At the same time a number information users' surveys have revealed that for most scientists current reading is severely concentrated among a few periodicals. As for example, C W Hanson has stated that such reading is restricted to about a dozen journals, on the average (34). Out of this, one may be a general periodical, like the *Nature* and another a secondary periodical. In the selection of the remaining ten, various considerations may play a part, such as one may be the organ of the national or most important professional society to which one belongs, a couple of them may be personally subscribed to and others may be considered as the most relevant journals in the area of one's study and research. All these together may be considered as the most favourite journals of an individual. There is hardly any evidence to show that any foreign language periodical ever enters into this narrow range of most favourite journals of an individual. Thus, it

is evident that useful material in a foreign language does not come to the attention of a potential user as quickly as those which are published within the range of his favourite journals.

Scanning of Current Journals

A number of information users' surveys have revealed at the same time that one of the principal channel for keeping oneself abreast of current information or finding the existence of useful current material is the 'scanning of current journals in library'. The Sheffield survey, for example, recorded a high percentage (81.4) of use of this channel. The population of this survey consisted of teachers and research workers of a well known university. Naturally, all of them had easy access to a good library. Even otherwise, this is an important and dependable channel of locating useful material. It is quite obvious that if a library has foreign language journals and other material and displays them well, a reader who is not well versed in those languages will not be attracted much. In such a situation the publishers and editors of primary journals can provide some help by partial translation. For journals, either the titles of articles can be translated and given in a second language or additional contents pages in languages other than the language of the text of the contributions can be provided in the issues of journals. As is known, this is being practised by a number of Russian and East European journals. For most of them, the additional contents page is in English. Germany has a long tradition in such work. For some German journals, as many as three additional contents pages, with abstracts, are provided in English, French, and German. They are really good examples of 'documentation at source'.

Help from Publishers

There is another commendable practice amongst some journal publishers, whereby the summary/ resume of each contribution is presented in a different language. Some of the Japanese journals have taken to this practice.

Both the above practices can not only bring to the attention of potential users valuable contributions but can also help them in getting over the language barrier partially. Once this initial awareness or interest is created, it is certain interested users will find their way to get into the full contents of the relevant items. As has been said, in most cases such limited translations are being done by publishers to ensure that the contents of their journals reach a much wider audience across the language barrier. It is quite obvious that all publishers cannot easily provide even such limited translation of contents pages or summaries of articles. They have to have the necessary facilities which require some investments. Alternatively, larger libraries, especially university libraries can take up such responsibilities for those foreign language publications which are taken by them.

There is yet another type of agency which can perform a similar function. They are the publishers and compilers of current awareness bulletins. The *Current Contents* has been presenting the contents pages of Russian journals in English. It may be recalled that the Sheffield survey recommended the extension of this practice to other languages in addition to Russian. Current awareness bulletins which are not of contents-by-journals variety, like the *Current Contents*, do translate the titles of articles into a common language more often. It should also be noted that the two methods mentioned, i.e. the publishers of primary journals providing translations of titles of contributions or translated contents pages and the publishers of current awareness bulletins providing such translation are inter-related. If the primary publishers provide the necessary translations they can be readily utilized by the publishers of the current awareness bulletins and other secondary publications. These

two activities together can bring the current literature in different languages to the attention of a wider audience and take them across the language barrier to a certain extent.

Help from Secondary Publications

Another important method of keeping abreast of current literature is the regular perusal of abstracting/indexing or secondary periodicals. As each one of these services is usually addressed to a particular language group, they help the group in getting over the language barrier to a certain extent. In fact, as C W Hanson maintains, this is the important secondary function of an abstracting/indexing service. As is known, the most comprehensive abstracting service in the subject of Chemistry, the *Chemical Abstracts*, covers only about 50% literature in English. The remaining 50% is from languages other than English. The abstracts of this non-English literature is also presented in English. Thus, this service helps the English speaking chemists to get a view of the most important contributions in foreign languages even though they are not familiar with those languages. Similar services in other languages, such as the *Referativnyi Zhurnal* and the *Bulletin Signaletique*, must be doing the same function for the Russian and French knowing scientists.

Other Channels

There are other methods or channels for coming to know about relevant and useful documents that are usually mentioned in information users' surveys. They are: getting to know through personal contacts and communications, by attending meetings and conferences, through citations in documents read, through reviews, etc. One can come to know about the availability of a document in a foreign language through any one of those methods. However, none ofthem appears to be very effective in this regard. Take for example the method of getting to know through citations. The Sheffield survey has revealed that more than 90% of the references in the writings of the British scientists are in English. The picture is not likely to be very different for authors in other English language countries. This being the situation, only a very small proportion of the literature in foreign languages actually comes to the attention of English language readers through this method.

It is in this context that one will find it surprising that the *National Survey of Translation Needs of India*, which has been discussed earlier mentions that 89.5% of the respondents had checked that the documents they wanted to be translated came to their notice through citations. The other methods of locating useful foreign language publications were through secondary periodicals (41.9%), conference participation (37.1) and personal communication (25.7%). When citation of foreign language literature is so scarce, this method can have only a very limited use in the location of useful material in foreign language. At best this brings to notice only old documents.

The Case of the Science Citation Index

When discussing about citations, it is but natural that one should take into consideration the effectiveness of the *Science Citation Index* also. After all, this tool is based entirely on the citations in the current literature. By its very nature of compilation it can conveniently bring to the attention of a user a host of useful foreign language references under the details of one of his known documents, in his own language, if only some workers had cited them in their own contributions recently. However, there is a feeling that the *Science Citation Index* has a bias towards English language source journals in its selection policy. On this issue J Michel (52) has recently pointed out, "...*Science Citation Index* itself is introducing a significant distortion in picturing science and in measuring the impact of scientific work because this data base, due to the selection criteria used, is strengthening the linguistic

barrier". He maintains that it has only helped to create a vicious circle which develops as follows: "The best publications are the most cited articles. The most cited publications are articles which are the most read. English is the most common language in the scientific community. In order to be cited, it is better to publish in English. Therefore, publications in English are probably the best ones and will have to receive top priority in selection." J Michel further goes on to warn, "This position is very dangerous and is progressively creating a kind of English speaking community ghetto, in which many people determined to get the most valuable information are very reluctant to take into account any non-English written documents". Surely, the view point of the non-English countries on the effectiveness of the *Science Citation Index* to highlight the contributions in languages other than English has been very forcefully expressed.

Indexes of Translations

A very closely related aspect in the context of bringing relevant foreign language material to the attention of their potential users is the question of extent of use of the specialised indexes and guides of translations, especially of unpublished *ad hoc* translations, that are being compiled and made available by a number of translation pools and other agencies, such as the *World Transindex* and the *Translations Register-Index*. The NLL survey (76) had probed into this question by asking the respondents about six important guides/indexes that were available during the period. The results are reproduced in Table 19.

Table 19: Awareness and use of Guides to Translations

Guide	Aware of	Make use of
Technical Translations	17.3%	7.5%
NLL Translations Bulletin	21.6	7.0
Translation Bulletin	3.3	0.7
Aslib Translation Index	21.0	6.3
NLL Russian Translation Index	17.4	6.9
Catalogue Mensuel des Traductions	11.0	0.2

It should be observed in the table, that the relatively higher percentages are against four titles which are of British origin. On the whole the percentages of awareness and actual use of these guides are extremely low. The Sheffield survey had also asked about some of these guides. It was found that 91.2% of the respondents had never used any of them and interestingly, 12.6% also admitted that they had never heard of their existence. The NLL survey report had argued that the poor use of the guides was partly attributable to the availability of a large number of them which one had to consult in order to be certain that a translation does or does not exist. If a frequently circulated single index/guide listing translations into various western languages was available the task of locating translations would be much easier and more scientists would probably be prepared to use such an index.

On the above observations of the NLL survey report some comments would be relevant. All the guides/index mentioned in Table 19, on which responses were recorded are now extinct, suspended or have been amalgamated with other indexes. As for example, the *Transatom Bulletin, Catalogue Mensuel des Tranductions, World Index of Translations* have all been amalgamated into a single new index entitled the *World Transindex*. Similarly, all unpublished translations done in Britain can be located in the new index - the *British Reports, Theses, Translations*. Hence, it would be interesting to find out whether this new trend of coverage in the specialised indexes of translations has actually increased scientists' awareness and use of the indexes in some measure.

The other comment is on the possible or intended use of the specialised guides/indexes. Like all other bibliographical tools these guides also can be used in two different ways. They are: (1) to find out whether the translation of a specific foreign language document is available in the favoured language and, if available, how exactly a copy can be obtained, (2) to scan the newly made translations in one's broad subject field. This is more like a current awareness function in the limited area of translations. In most of the surveys, it appears, more emphasis have been given on the first function or use of the guides, i.e., to find or locate a translation. Very little information is available on the second function of the guides. However, there is no reason to believe that they are doing anything better in their second function. In fact, the Sheffield survey report had mentioned that lists of translations in broad subject fields, when published in primary journals, were better used, e.g. list of translation in the *Journal of the Iron and Steel Institute*, than the more comprehensive specialized guides/indexes. This point should be given proper attention.

So far as the first function is concerned, one may argue that more than the end users the librarians and other information workers should be familiar with the specialised guides of translations and they should be able to use these tools as effective check lists. Hence, it is more important to find out how far the community of librarians and information workers are really familiar with these tools. In this context it would be interesting to note that the *Union List of Current Scientific Serials in India 1981* records that out of the 785 major academic, research and special libraries in the country only two are getting the *World Transindex* and only one the *Translations Register-Index*. In such a situation, there is hardly any scope for their wide use either as finding tool or as current awareness tool for translations by the community of librarians and the end users.

One related question to the finding or location of a translation, especially when the original document is an article in a periodical, is to get the information whether the particular periodical in question is available in a cover-to-cover translated edition, including selective translation, etc. and if so, since which volume or year. There are lists of such periodicals e.g. *Journals in Translation*, and it is also necessary to find out the extent of awareness and use of such lists by librarians and the end users. In this context it may be mentioned that the NLL survey had asked the respondents to mention the titles of foreign language periodicals which they would like to see translated cover to cover. Of the 92 titles which were listed in response as many 22 were already available in translation. This is another evidence of prevailing ignorance regarding location of translations.

How to Locate and Obtain Translation

It would be worthwhile to consider the steps an information user is likely to take when he finds a reference to foreign language document or the document itself till he is able to get the information contained in it and also assess the facilities that he can use at every step.

The channels or methods of coming to know of foreign language documents are several and they have already been discussed in some detail. One point should be obvious here that the problem of increasing volume of current literature and the problem of language are very much inter-twined. In other words, the problem is that of current awareness. The tools that have been devised to provide better current awareness services have to be realigned, wherever necessary, and utilized for providing better access to foreign language material. It does not mean just increasing the coverage of these tools, but also featuring the items in a manner that will bring them to the attention of their potential users irrespective of the language of the text.

Self-Help and Linguistic Independence

Once a foreign language item is located which appears to have a bearing on one's current work the quickest and easiest way is to try and decipher the meaning of the paper without any assistance. This is an occasion when one is willing to reawaken one's limited language skill or proficiency and use it to the utmost. Strangely enough this skill is not regularly used to browse through journals for current awareness. This shows that scientists in general avoid direct exposure to foreign language literature. In one's effort to translate the text himself, a scientist is surely helped by his knowledge of the subject and the use of many common words and expressions in scientific texts. The best help that can be provided to him at this stage is to make available collections of specialized dictionaries and glossaries. This natural tendency to maintain linguistic independence is important.

Help from Colleagues

It is only when one's limited language proficiency supported by dictionaries and glossaries is found to be insufficient in getting the correct meaning of the foreign language text that one looks for help. Such help is usually sought among one's colleagues who may be having better language skills. Naturally, those scientists who are working in a bigger establishment have a better chance of getting such help. People working in the context of a big academic institution, like the university, where language departments may be located, are in an advantageous position so far as this help is concerned. When a person is looking for such help only, it is quite likely that he is not interested in getting the whole text translated. May be, he wants to find out the line of reasoning that the author has followed, or the nature of the experiment that has been done, or the results that have been obtained. In some cases if only the headings and legends of a couple of tables in the foreign language document can be deciphered, one can get along with it. Libraries and information centres can also provide such help. An experiment conducted at the BLLD fully corroborates this point (75).

Location of an Abstract

If the item of interest is located by a method other than scanning an abstracting/indexing periodical, then the first line of approach may be the location of an abstract. It may be recalled in this context that an abstract is usually prepared to meet the requirements of two categories of readers - (a) specialists in the subject, and (b) others who have 'fringe' interest in the subject of a document. For the first category of readers the abstract should help them to decide whether the document should be read in full thus acting as an appetiser. For the second category it should contain enough information to obviate the necessity of reading the full document. Thus, reading an abstract is likely to meet the requirements of a large number of information users.

Acquisition of Language skills

Closely related to the tendency to maintain linguistic independence is the question of acquisition of language skills through self-study. Fracois Kartesz, who has sufficient experience in the matter, observes that a good technical man is well known for his intellectual resiliency (45). He can easily take to the study of a new discipline. Engineers become expert environmentalists in a short time through informal self-study or continued exposure to a new field. Similarly, old physicists or biologists, who completed their education before the computer era, willingly take up programming language courses and learn a new skill. However, it has also been observed that the same technical men show considerable reluctance to tackle a new 'natural' language.

One useful method of getting over this initial reluctance has been the introduction of self-study books like J W Perry's *Scientific Russian*. There are now a number of books of this nature. The main approach in them is to eliminate rote learning and by-pass the usually uninteresting grammatical material which bores adults who undertake the study of a language for personal gain and satisfaction and not for college credit. This is essentially a library-based approach. This can be very profitably supplemented by imparting special language classes.

The Aslib study[33] of 1962 did take stock of the usefulness of the special language courses of various duration in Russian that were available in Britain. It was found that out of a sample of 169 persons, 8 had undertaken a course offered by the NPL which required 180 hours tuition over two years, and all the 8 were able to make sense of Russian in their subject. It was also revealed that the maximum amount of time needed to provide such special language course is about 200 hours. Another interesting point of this aspect of the study was that out of 116 scientists in the sample, 76 were using their language skill mainly for own benefit, 23 mainly for colleagues, 10 equally for own benefit and for colleagues and 7 did not respond to the particular question. This shows that specialised courses can be useful in two ways - by making scientists self-reliant in translation work and also be of help to their colleagues.

Group Initiatives

The above was mostly a description of the steps that are taken at the individual level supported at times by certain institutional facilities. Let us consider now what steps are taken when a document is located which requires full translation and the individual nor his colleagues are in a position to do the job by themselves. Several alternative agencies may be available who can do the translation on payment. However, everybody knows that translation is a costly and time-consuming business. Hence, the first step usually taken is to find out whether the document in question has already been translated and is available.

Because of the expensive and time consuming nature of translation work, it has been possible to bring about fairly good degree of voluntary cooperation in this field than in many others. Needless to say, this is relating to all unpublished translations. When a document is translated and is also published it gets into the various bibliographies, including national bibliography, and catalogues and, hence, can be located like any other unpublished material. Translations constituted till recently a comparative uncharted area of the bibliographical world. With the increasing awareness of the language barrier and the necessity to consult foreign language material, this area is now getting well organised with a whole set of new bibliographical tools and translation pools. Some aspects of this new organisation and tools are discussed below.

The main objectives in the organisation of translation pools have been the avoidance of duplication in costly translation effort and making existing translations available to others who may be interested in them. There are now national and international pools aiming at comprehensiveness. The usefulness of any pool or its index for a scientific community or a country depends very much on which side of the language barrier it is located. First, let us take the cases of some pools in the English speaking countries.

Translation Pools in Britain

Before the advent of the BLLD, the most important scheme in Britain was the Aslib Index[31] established in 1951. In 1960, an exchange system was arranged through the Commonwealth Scienti-

fic Council which enabled various Commonwealth centres to receive copies of all entries in the Index, then called the *Commonwealth Index of Unpublished Translations.* In return Aslib was supplied with details of translations notified to these Commonwealth centres. In 1975 both the British Government support for the Index and the cooperation of the Commonwealth Scientific Council ceased. Since then the scheme has been limited within the corporate members of Aslib.

The Aslib Index is maintained in card form and supplies the name of an organization which holds a particular translation. No translations are held at Aslib. The majority of translations available with the BLLD and a number of American translations which have been deposited at the National Translations Centre, Chicago and listed in the *Translation Register-Index* are listed in the Aslib Index. Translations listed in publishers' catalogues and library accession lists are also noted. Translations which are in process or will be taken up in the future are also recorded. The Index includes only translations into English, but there are no restrictions on the language of the original. In the operation of Index, Aslib has been functioning more as a clearing house for information relating to translations. Actual translations are held and copies supplied by a large number of cooperating organisations both in Britain and other countries. Such a system, naturally, causes some delay in the procurement of a translation. To get over this difficulty the concept of creating translation banks has come. In Britain, the BLLD has been given the responsibility of operating as a translation bank, along with its other responsibilities.

The BLLD collects translations from various sources and make them available to interested persons. Announcement of acquired translations in an important function of all translation banks or pools. For a long time this function was carried out through the NLL Translation Bulletin and was replaced by the BLLD Announcement Bulletin. Presently, this function has been taken over by the British Reports Translations Theses (BRTT). This new bibliographical publication takes care of three important types of documents.

Translation Pools in the United States

In the United States, more or less, a similar organisation prevails. Here also the library profession first recognised the need for an efficient mechanism to collect and locate individual unpublished translations. In 1953 the Library of Congress started collecting translations from the Russian. At the same time, the Translation Pool of the Special Libraries Association at the John Crerar Library in Chicago began collecting translations from other languages into English. In 1968 the Special Libraries Association handed over the sponsorship and administration of this translation bank, renamed as National Translations Centre (NTC) to the John Crerar Library.

The NTC is the main depository of scientific and technical translations into English in the United States. Its national status in maintained by the representation of a number of major scientific societies, translators organisation, the legal profession and library and information science associations, in its Advisory Board. The Centre collects translations from different sources, such as, federal agencies, non-governmental organisations and research-oriented companies, professional translation agencies, and organizations in foreign countries where translations are prepared at the request and expense of the US Government.

The Centre has prepared and published a number of regular indexes and announcement bulletins in the past e.g. *Translation monthly*, 1955-58, *Technical translations* 1959-67. Since 1967 a more comprehensive index is being published by it under the title *Translations Register-Index*

(TR-I): This is a semi-monthly journal. The Register section of TRI announces the newly acquired translations and features them under the subject categories according to COSATI classification and terminology. The Index section includes journal citations, patent citations, conference papers and monographs and these are cumulated quarterly.

Another important agency in the United States is the National Technical Information Service (NTIS). As is well known this agency is the main source of technical reports, mostly unpublished, which originate in the various federal departments and offices. Along with technical reports, the NTIS has also been procuring copies of translations from the same federal agencies with a view to make them available to the public. For announcing the acquisition and availability of these translations, the NTIS first makes use of its own bulletin, the *Government Reports Announcement.* They are again notified in the NTC's publication, The *Translation Register-Index.*

The International Translation Centre (ITC)

The Centre came into existence in 1960 under its former name the European Translation Centre (ETC). The present name was assumed in 1975. It is located at Delft in Netherlands. The Centre was established largely as a result of a wide scheme of voluntary cooperation amongst Western European countries, stimulated by the United States and guided by the Organisation for Economic Cooperation and Development (OECD). The general aim of the ITC is to act as an instrument for the exchange of information by means of translations and prevention of duplication of translation work. This is how it obtained the support of a number of national translation centres and many cooperating organisations.

It should be stressed that the ITC does not prepare translations itself. Its main function is to keep a central reference catalogue and to run an information bureau for handling requests for and information on translations. In short, it performs only those operational tasks which it feels can be better performed an international level.

For the notification of translations the ITC is publishing the *World Transindex* since 1978. This publication is, in fact, jointly brought out by the ITC and the Centre National de la Recherche Scientifique (CNRS, Paris) and has replaced three former publications, namely the *World Index of Scientific Translations and List of Translations Notified to ETC: Translation Bulletin: and the Bulletin des Traductions.* The World Transindex is published monthly in 10 issues per volume per year. An Annual Index is published separately which cumulates the source index and Author Index for each volume. Each issue has two main parts – the List of translations arranged according to COSATI classification scheme, and the Source Index, with an Author Index.

When ETC was formed, British became a full member represented by the BLLD (then NLL). Experience soon showed that ETC was of only marginal use to Britain and BLLD withdrew their membership for some period. There is very little chance of finding an English language translation in this pool which is not in either the BLLD, Aslib or NTC indexes. The use of ETC has, therefore, been restricted to those who speak other western languages.

Other European Translation Centre

The Centre National de la Recherche Scientifique (CNRS) has its own translation service within its documentation centre and collects information on translations from all non-English languages

into French. CNRS cooperates with many French and Canadian translation organisations. The Technische Informations bibliotheck (TIB) in Hannover has its own translation service and collects translations from Slavonic and Asiatic languages into German and English which have been produced in the Federal Republic of Germany. These translations are announced in the appendix of ten separately issued monthly information bulletins named *Ostsprachige Fachliteratur*, each of them pertaining to a specialised scientific or technical discipline.

The Centre Belge de Traductions (CBT) part of the Bibliotheque Royale in Brussels, collects translations produced in Belgium from Slavonic and Asiatic languages into French, Dutch, English or German. The Danish Translation Centre (DTC) attached to the Atomic Energy Commission in Roskilde, collects translations produced in Denmark into English and French and notifies them to the ITC. The European Commission's Transatom Service collects information on translations from Asiatic and Slavonic languages into all official languages of the European Community in so far as these translations pertain to nuclear science and its application to other disciplines[29].

The Trsnalsation Scene in the USSR

According to George Chandler[15a] the biggest depository of translation in the USSR is the State Public Scientific and Technical Library (GPNTB). This library was not only entrusted with collecting translations of foreign literature on science and technology, it was also made responsible for coordinating translation work to eliminate duplication of effort. No organisation was to undertake a written translation of a foreign publication unless the coordination centre confirmed that publication had not been translated by another organisation. If the translation was available at the GPNTB's specialized collection, all those interested could receive copies at a small charge.

According to a recent report, further changes have been introduced in the matter of coordination of translation activities[48]. The new arrangement proposed and which became effective from January 1983, is contained in a new standard, GOST 7.36-81 (Unpublished translation Coordination, general requirements and presentation rules). This standard determines the procedures for coordination of work of organisations in all branches of the national economy of the USSR and the union republics as regards translations into Russian of foreign literature and documents in science and technology and the general requirements and rules for presentation of unpublished complete translations.

The functions of national coordination of translation work are to be implemented by three All Union Scientific and Technical Information Agencies. They are:

1. All Union Centre for Translation of Scientific and Technical Literature and Documentation (VTsP) of the USSR State Committee for Science and Technology and Academy of Sciences of the USSR.

2. The All-Union Scientific Research Centre for Patent Information (VNIIPI) of the Research and Production Association "Poisk" of the USSR State Committee for Inventions and Discoveries, and

3. The All-Union Information Collection of Standards of the All-Union Scientific Research Institute of Technical Information, Classification and Coding (VIFs VNIIKI) of the USSR State Committee for Standardization.

VTsP is to function as the leading All-Union Centre for coordination of the translation of scientific literature and documents, including books and parts of books; serials and articles from them; R&D and D&D reports; proceedings of international and national conferences and other meetings; and compact publications (industrial catalogues, prospects, etc.). Similarly, the VNIIPI and VNIIKI are to function as the coordinating agencies in their respective fields of patent and standards.

All coordination centres are to perform the following functions:

a) registering "requests for translation";
b) keeping translation files;
c) organizing a reference information facility; and
d) providing reference information services

Registration of all translations of scientific and technical literature and documents done in the USSR is obligatory. A registration number is assigned to the "request for translation", which serves as the basis for issuing permission for translation. For organisations affiliated with STI specialised systems, the time allowed for verifying the availability of a previous translation in the reference information system of the specialised and national collections is 3 to 4 days, for other organisations, this work has to be done within 2 days. When a translation is available from the specialised or national collections, the requesting organization receives its copy in the mail. If no translation has been done previously, it is issued permission for translation.

All organizations and enterprises across the country after receiving permission for translation are required to supply an obligatory (first) copy of each completed translation to the national file of translations at VTsP, VNIIPI, or VIFs VNIIKI respectively according to the nature of the document. In addition to the national file, TsOONTI keep their own specialized files of second copies of translations made by the organizations and enterprises.

Thus, it would be obvious that there is some fundamental differences in the organisation and control of translation activities in the English speaking countries who are interested in knowing about new scientific literature generated in other countries, especially in the Soviet Union, on the one hand, and the Soviet Union where scientists are interested to find out what is now in the literature published in the English speaking countries. Translation in some form and at some point is important but it has also been realised that control of these translations is also equally important. In the English speaking countries and in Western Europe the methods for finding out whether a required document has been translated or not is to contact one of the translation pools or consult the indexes published by them, such as the *Translations Register-Index* and *World Transindex*. In the Soviet Union, on the other hand, there is no necessity of such published indexes. The most important instrument of control and coordination of translation activity seems to be the "request for translation". These requests help the coordinating centres to build up their information files which can provide most reliable information to the end users. By the registration system the centres can easily maintain information about all translations in process. Thus, this truly centralised system of coordination and control of translations can provide better, guarantee against waste duplication of effort and promise better utilization of translations already done.

The Index Translationum

Any discussion on indexes and guides to translations will remain incomplete without the mention of the *Index Translationum* which appears annually and is published by UNESCO. This is an index of translations which are published in the form of monographs in the Member States of UNESCO. In the mid-1970s, world totals of between 45,000 and 50,000 book translations were recorded each year. Of these as many as 75% were translated from four or five main European (and North American) languages, leaving a mere 25% translated from the remaining seventy to eighty languages for which information was available. Out of 1200 and odd copies that are being sold about 1000 copies go to the North America and Europe, Asia takes on about 50 copies, South America about 30-40 copies and Africa 20 copies only.

Translation and Cover-to-Cover Translation of Journals

It is believed that the most obvious solution to the foreign language problem is the complete, i.e. cover-to-cover translation of foreign language journals. At least in the English speaking countries this view has a strong support. However, it is also believed that this is the most expensive solution. Because of this the number of journals available in cover-to-cover translated form is not many. The most comprehensive list of translated journals of all varieties i.e. the *Journals in Translation* published by BLLD (1976) cover 1173 titles and out of which only half are true cover-to-cover translations into all languages. The majority of such journals are from Russian into English.

It is quite obvious that the number of cover-to-cover translated journal is quite small when compared to the total number of available journal titles. Even then, if one is certain that the most important and also the most widely used and cited foreign language journals, are also available in translated edition, then overcoming the language barrier becomes quite easy. How far these journals have been successful in practice and other aspects of them have been studied by different authors[7, 45, 65]. Only some of the important points are discussed here.

Effect of cover-to-cover Translations

It has been observed that *ad-hoc* translation of single articles continue to be done from journals which have cover-to-cover translated editions. There are several reasons for this apparent misuse of effort. One important reason is the delay in the availability of the translated version. Statistics show that seven to twelve months time-lag is quite normal between the publication of the original and the translated versions. This time-lag appears to be too long, for some. For them time is more important hence they are prepared to pay the extra amount for an *ad-hoc* translation. In C W Hanson's study[33] an analysis was made of such cases. Out of 59 translated journals all from Russian into English studied, it was observed that after cover-to-cover translations were available, the making of translations of individual articles stopped completely for 9 journals; decreased to varying degrees for 26 journals; remained about the same for 10 journals, and increased to varying degrees for 13 journals. Thus, all the possibilities were seen.

From the above findings it becomes evident that the cover-to-cover translation has two clear functions. Elimination of individual translations from some journals and decrease in the demand for such translations from a large number of journals proves that cover-to-cover translation is an

effective means of meeting a demand for translation. At the same time increase in the demand for individual translations from some journals and continued demand for such translation from some other journals indicate that "cover-to-cover translation is a disseminating medium in its own right and part of its function is to arouse curiosity."

In whatever way one looks at it, one point is clear that in the present state of cover-to-cover translation practice some amount of duplication in translation effort is there and it will continue. F Kertesz reported a case when an article was translated three time by three different agencies[45]. First, a single article was translated from an issue of the Russian journal *Atomnaya Energiya*. This translated article caught the eyes of other which resulted in the translation of the whole issue by the Joint Publications Research Service (US Department of Commerce). After a few months the cover-to-cover translated version of the same issue appeared. Such multiple translations represent a costly and unnecessary expense for the agencies serving the scientists.

Causes for Duplication of Effort

In this context one question will be inevitable. Can the reason for wasteful multiple translation be due to ignorance or difficulty of ascertaining the availability of cover-to-cover translation? The ignorance or the difficulty may be both on the part of the end users or the intermediaries i.e., librarians and information workers. From some figures supplied by Mickey Risseeuw[59] of the ITC it becomes clear that there is some substance in this doubt. A sample of requests taken by the ITC during the period October-December 1979, gave the following results:

Total No. of requested translations	...	1764
Total No. of located translations	...	413
Sources of located translations ...		
- Translations in cover-to-cover translation journals	...	192
- Published translations, such as AD, PB, TT documents	...	48
- Others (translations not published)	...	173

The above figures clearly show that the largest number of translations were located in cover-to-cover translation journals. Such a situation proves that there is a genuine difficulty in finding out for certain whether a particular foreign language journal is translated cover-to-cover, if so, since which volume or year this is available, under what title it appears, where the translated version is available and so on. That is why such a large number of these requests go up to the ITC for location. The difficulties mentioned and the tools available to get over them need to be discussed here.

How to find out the Existence of a cover-to-cover Journal

The first problem is to find out whether a translated version of a particular journal exists. Such information is usually made available by several published guides. Such guides are of two varieties - guides published by translation banks and pools and guides compiled and published by individual authors, library association and others. The most dependable guide of the first variety has been a listing of such journals that appeared in the annual cumulative issue of the former World Index to

Scientific Translations. This was subsequently published as a separate book in 1974 under the title *Translation Journals.* After this there appeared in 1970 another guide entitled *Journals in Translation* published by BLLD. Both the BLLD and ITC collaborated to produce the second edition of *Journals in Translation* which was published in 1978. The most important guide of the second variety is a compilation by Himmelsbach and Brociner which was published by the Special Libraries Association.

Even a cursory glance at these compilations will reveal that they are not simple listings of translated journals. Great care has to be taken and a lot of details included in their compilation for making them answer some of the approaches mentioned above and many more. The BLLD guide, for example, provides a KWIC index to the English language titles providing a fully cross-referenced subject index to the journals. The guide by Himmelsbach and Brociner contains many novel features, as for example, there is an index to frequently encountered Russian abbreviations of journals. This index is extremely useful because of the Russian habit of using acronyms as abbreviation of journal titles in their references, for example, ZHETF for *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki.* Similarly, the date and volume from which translated edition of a journal is available is very important for obvious reason. There are a few cases where the translated edition has started from the middle of a volume of the original. Another important item of information for indication is the time lag between the appearance of the original and the translation.

Publication aspects

Several authors have discussed the publication aspects of the cover-to-cover translated journals. Most of these journal have been started during the period 1955-65 although there are a few earlier ones and new titles appear from time to time. There are only a few publishers, such as Consultants Bureau and Allerton Press, who are specialised in this area. Other titles are mainly published by scientific societies and government agencies. Learned societies often get grants from government agencies for such publications. It is often complained that the cover-to-cover journals are very costly. The average subscription price is something like $ 100 to $ 150 per year. The high price is mainly due to high cost of translation, which in turn results in relatively low circulation. In fact, this has resulted in a vicious circle- unless the subscription price is lowered circulation cannot increase and unless the circulation increases the subscription prices cannot come down.

Librarians and information workers often complain of the bibliographic confusion that the cover-to-cover journals have created in the matter of citation. This is due to the presence of the same article in two journals. The title of the translated journal, in many cases, is not a translation of the original, but a paraphrase. Paginations are likely to be different. This problem is faced by the secondary publications also.

Economic Aspects

Some authors have even questioned the very 'cover-to-cover' philosophy. Is not the 'custom-made' translation of really useful foreign language articles a better policy than the 'mass production' approach of cover-to-cover translation? This question was reviewed by the National Science Foundation survey, entitled *Providing US Scientists with Soviet Scientific Information,* as far back as 1959, and concluded that "to provide full translations in broad subject fields has been found preferable, to guard against inadvertent omissions and to facilitate bibliographic handling. An

economic study of this approach has been made, and the results show that even if only one paper in forty is of general interest, it is cheaper to translate all forty of them than to determine which one to translate."

The above pronouncement, apart from revealing the new eagerness to get over the language barrier in the immediate post- Sputik era, brings out two important points of the cover-to-cover philosophy. They are - fear of missing important information through inadvertent omissions and the economic aspect of translating whole issues of journals. In a commentary on cover-to-cover translations, included in the Hanson report[33], D J Urquhart provided further support. He maintained that the production of such journals depended, in most cases, on an assessment by a scientific society or a research organisation that the effort involved was scientifically worthwhile. Further, although the cost of production of a cover-to-cover translation is borne or heavily subsidised by governmental agencies, the subsidy does not compensate fully the sponsoring organization for the headaches such a production creates. This factor is, in a way, a guarantee against the continued production of cover-to-cover translations containing a high proportion of 'bad or 'unwanted articles', is also some guarantee that the quality of the translation work is higher than that of *ad-hoc* articles, some of which are not edited.

Actual Use of Cover-to-Cover Translations

In spite of the above guarantees, the use of cover-to-cover translations does not appear to be very widespread. Low circulation figures are some indication. Francois Kertesz stated very definitely that the experience of the Oak Ridge National Laboratory libraries with translated journals confirms that this approach, i.e., the cover-to-cover philosophy, had failed in its main goal, which was to serve as a current awareness medium to acquaint researchers with the trends and results of current Soviet research. The journals were not used for browsing, they served only to locate specific articles of which the reader became aware of through other sources. In this context one of the findings of the NLL survey may be recalled. In reply to a question regarding titles of foreign journals which the respondents wanted to be translated cover-to-cover, ninety-two Russian titles were listed, of which twenty were already available in translation. This can be taken as a conclusive evidence of the poor use of the cover-to-cover translation journals. For many of the developing countries, the high subscription price of these journals can be a contributing factor of their poor use.

As has been said earlier, the use of a scientific journal depends on a large number of factors. Every scientist has to choose and settle for a small number of titles out of many that may be available to him. Very often the selection is very much determined for him by the scientific tradition and culture in which he has grown up. Anything that is not a part of this tradition and culture is not likely to be easily accepted. One more point needs to be mentioned here, which is on the physical production aspect of the cover-to-cover translations. Readers in the USA, Britain and some countries in Western Europe are accustomed to a certain standard printing, presentation and editorial support in journal publication. Similarly, the countries of Eastern Europe have a different standard in these matters. Quite strangely, most of the cover-to-cover journals, which are being published in the USA and Western Europe, a different standard is maintained. They do not mix up easily with the other publications of those countries. They stand out as something alien.

The Basis of Cover-to-Cover Philosophy

Cover-to-cover philosophy, as has been seen, has its roots in the English language countries. Further,

translation effort is largely concentrated on Russian to the exclusion of German, French, Japanese and Chinese. This is because much less is published in these languages than in Russian and also English speaking scientists have a greater fluency in French and German than Russian. Some portion of the scientific contributions of these countries are also available in English, but contributions from the Soviet Union are mostly in Russian. Compared to Russian, the volume of literature in Japanese and Chinese is less. It may also be added that cover-to-cover translation into English is commercially viable because of the large world-wide potential market. Because of these reasons, cover-to-cover translation ventures are most likely to be restricted to some of the major languages only.

The Scenario in Non-English Countries

The scenario in the non-English countries is likely to be quite different in the absence of cover-to-cover translations. This absence can be explained by reserving the logic mentioned in the previous paragraph. First of all, foreign language proficiency, particularly with English, is far better in non-English countries compared to English speaking countries. Just to give an indication of this fact, again Francois Kertesz's[45] observations may be mentioned. He said "At the First Geneva Conference on the Peaceful Uses of Atomic Energy, the American participants discovered that although nearly all of their Soviet colleagues spoke English or another major Western language, such as French or German, only one (Russian-born) member of the American delegation spoke Russian." In another paper, J Michel claims that, "...the main losers of information through written communication are English speaking people. Among them, only 12% are able to read French documents and 4% German, whereas, 97% of French and German scientists are able to read English[45]. Also, cover-to-cover translation of any English journal will have even smaller circulation than the cover-to-cover translated non-English journals are having. They will not be economically viable.

An Alternative

In view of the above, the Soviet Union has developed an alternative to cover-to-cover translation. This has come in the shape of *Ekspress Informatsiya* from the VINITI. This service is generally available on narrow applied science fields. There are more than 75 series and each series appears four times a month. Each issue contains short translation, into Russian, of five to ten articles selected from foreign journals. The length of the translated articles run from two to fifteen pages. Diagrams, tables, formulae, etc of the original articles are usually retained in the translation. Naturally, the idea is to obviate the necessity of referring to the original text and ask for a full length custom-made translation, as far as possible. Two most important advantages of this service over cover-to-cover translation method, are: 1) the user continues to get abridged translations of several foreign language articles on a narrow subject field within about a month after their publication, whereas a cover-to-cover translation takes much more time and all the items may not be of one's interest, 2) low cost of this service allows everybody to subscribe for it. It has to be admitted that *Ekspress Informatsiya* is highly selective. Only those articles in foreign journals are included which are likely to be of interest and value to the Soviet scientists. Selection has to be very judicious.

The Soviet Union has another method of bringing the foreign language literature to the attention of its scientists. This is the publication of full translations of selected articles from several journals in a translated journal. *Atomnaya Tekhnika za Rubezhom* (Nuclear Engineering Abroad) is a good example of this variety of translation journal. It publishes selected articles from Western

(US, British, German, French, etc) journals, grouping them on the basis of a specific area of interest within the nuclear fields, such as enrichment techniques, reacter safety, etc. Here again, the usefulness of such translation depends very much on the judicious selection of material of current interest. It is believed that such journals can meet the current awareness requirements in a better way than the cover-to-cover journals.

The views expressed above surely calls for a review of the cover-to-cover translation philosophy.

Machine Translation (MT): the Ultimate Solution

Like many other problems, the ultimate solution to the language problem appears to be in the effective use of the computer. However, many of the early MT demonstrations had over simplified the problem which created an optimistic view of the concept. This early optimism is typified in the following pronouncement, "....I breathed a sigh of relief. No longer must I study foreign languages; soon lightening fast computers would be able to translate anything I wanted to read into English, sparing me from years of tedious study..." Very soon, those who harboured such optimism had to say in a pessimistic note, "....years later I do not know any foreign language, but computers donot either." In fact the problem proved to be more difficult than anticipated.

The efforts in MT suffered from criticism of the ALPAO Report (Automatic Language Processing Advisory Committee) of the National Academy of Science (USA) in 1966. Since then the image of MT has been corrected and a number of institutions in many countries are actively engaged in MT. Some of the well known MT systems in various stages of development are: SYSTRAN (Russian-English), CULT (Chinese-English), METEO (English-French), TITUS (German/English/French/Spanish), GAT (Russian-English) and AMPAR (English-Russian). It may be stated that in the field of MT also, English appears to be the most important language, both as source and also as target language.

Closely related to the problem of MT is the question of computer- aided translation. In this case the computer is asked to do what it can do best - to store and retrieve, on demand, the specific equivalent of words in another language in a convenient form to help the human translator to do his best. In other words, the computer is made to supply an automatic dictionary as a powerful tool for the use of the human translator.

Another similar line of investigation is the computerised generation of bi-lingual and multilingual thesauri. The success of such investigations will help in the automatic indexing of documents in abstracting/indexing periodicals, bibliographical data bases and so on.

All these developments, if successful, are going to change the nature of the language barrier to a considerable extent.

Conclusion

Many observers see translation, as a solution to get over the language barrier, as a bottleneck in world activities comparable to the energy crisis and the crisis of raw materials[34b]. At the same time adoption of a single international language has also been ruled out as a solution. J A Large[50] maintains that "a world language would provide the answer to the foreign language barrier, but at a

price". The nature of this price has been indicated in another source[15b] in very clear terms. It says, "Adopting a single international language would result in the creation of a caste of 'scribes' who would rapidly find themselves tempted to dominate the people and consequently be resented by them. Under these circumstances to adopt a single language would take civilization back several centuries for most individuals, and would kill democracy and all popular cultural development". That is indeed a very heavy price that we cannot afford to pay.

RECOMMENDATIONS

There is ample evidence to indicate that linguistic obstacles are coming in the way of production, dissemination and use of scientific and technical information in many countries. There is also a feeling, that such obstacles will continue to grow as more and more areas of the world, hitherto not fully developed, make progress in science and technology and develop their industries. They are likely to produce scientific and technical literature in their native languages. Even now the language barrier is quite difficult for many of the language groups. All groups are trying to get over the barrier in their own way. Taking careful stock of these activities, the following recommendations are being made to ease the situation.

1. The problem of the language barrier is being discussed and surveys conducted, in recent years, more in English language countries. Similar or more detailed studies and surveys regarding the language barrier as seen from the point of view of other dominant language groups and also some minor language groups or countries should be initiated to get a complete view of the global problem.

2. Scientific and technical literature has become multi-lingual but scientists and technologists continue to display a mono-lingual attitude in their approach to the literature. This is more so in the case of those who happen to be in dominant language groups. People in the minor language groups have to be, out of necessity, proficient in more than one languages. For the proper dissemination and use of scientific knowledge it has become necessary to review the language policies of dominant language countries. Perhaps, a change in their educational systems may be necessary.

3. There is some difference of opinion regarding the stage at which a foreign language skill could be most profitably acquired. One belief is that it can be best learnt at the high school stage. The other view is that for scientists it should be at the research level when motivation is quite strong and the skill acquired can be immediately utilised. Further, a foreign language proficiency, once acquired can be also used in helping a colleague.

4. For librarians and information workers, the necessity of having foreign language proficiency should be reconsidered. At least in bigger libraries, and information centres, persons should be available to provide oral interpretations of foreign language documents. For many readers such help would be sufficient and would also avoid unnecessary full scale translation work in many cases.

In the academic context, where language departments exist, close liaison should be maintained between the library and the language department to provide such help.

5. To encourage scientists and research workers in the use of foreign language documents, it is suggested that one component in research grant should be for translation.

6. The present system of collection and announcement of ad-hoc translations, though organised in some cases, is not fully effective. Every country, especially the developing countries, has to develop and maintain strong national focal points for the purpose. All translation requests could be routed to such points, who in turn could get in touch with the international or bigger translation pools to take advantage of already available translations.

7. The specialised indexes of translations are not being fully used. One alternative of announcing the newly made translations in relevant primary journals may be considered. The subscription prices of such indexes may have to be brought down, specially for the developing countries. Some international agencies may provide some help in the matter.

8. The coverage of bigger abstracting/indexing services or data bases should be really made comprehensive in different languages as this alone can give a true picture of the importance of contributions of different countries or language groups and such estimation ultimately leads people to look for documents in foreign languages or their translations.

9. The costly solution of producing cover-to-cover translated journals is mostly restricted to English language countries. In view of the actual use, high subscription rates and delay of such publications the very philosophy of cover-to-cover translation needs to be reviewed.

10. There is evidence to show that many of the articles which appear subsequently in cover-to-cover journals are taken up first as individual ad-hoc translations. However, there is no way to take advantage of the earlier translations by the publishers of the cover-to-cover journals. A mechanism needs to be created to pass on such benefits, which may to a certain extent bring down the cost of such journals.

11. The difficulties faced by authors in developing countries in getting their contributions accepted in usually foreign language journals published from advanced countries need to be investigated thoroughly. The point of view of editors of such journals also has to be considered.

12. As access tools, current awareness bulletins and abstracting/indexing periodicals, it is alleged, miss many foreign language documents. Review publications have, therefore, to be broad based so that they can provide another, and perhaps last chance, to the readers to get acquainted with the most important foreign language contributions.

13. Efforts and massive investments on machine translations have to continue. Before the ultimate objective of high quality lightning-fast translation is reached, the more immediate objectives of creating on-line dictionaries, multi-lingual thesauri, and limited-vocabulary translations can be reached.

14. In many developing countries and minor-language countries where scientists have to pursue their studies and investigations in one of the dominant foreign languages, it is feared that a wide gulf is created between scientists and the common people of these countries. The effects of this on the flow and use of information need to be investigated in details.

BIBLIOGRAPHY

1. Anderson, James D: Ad hoc and selective translations of scientific and technical journal articles; their characteristics and possible predictability. J Amer Soc Inf Sci, 1978, 29(3), 130-35.

2. Anderson, James D: Foreign language barriers in information transfer. J Educ Librnship, 1971, 14(3), 171-76.

3. Apathy, Edit: Language barriers of information dissemination (Hungarian). Az Orvosi Koenyvtaros, 1979, 19(3), 253-74.

4. Bailey, James F: Linguistic obstacles to the effective exchange of legal documentation. Int J Law Libr, 1976, 4(2), 91-100.

5. Beck, Leonard N: Key issues in Soviet information. J Amer Soc Inf Sci, 1971, 22(2), 81-84.

6. Beyer, R T: Hurdling the language barrier. Phys Today, 1965 (Jan), 46-52.

7. Birch, B J: Tracking down translations. Aslib Proc, 1979, 31(11), 500-11.

8. Bottle, R T and Wyatt, H V: Use of biological literature. London, Butterworth, 1971.

9. Breton, R: Géographie des langues. Paris, PUF, 1976.

10. Bruderer, H E: Handbook of machine translation and machine-aided translation. Amsterdam, North-Holland, 1977.

11. Bruderer, H E: The present state of machine and machine-assisted translation (*In* Overcoming the language barrier. 3rd European Congress on Information Systems and Networks, Luxemberg, 3-6 May 1977). Munchen, Verlag Dokumentation, 1977.

12. Chakraborty, A R: Translations at editorial level. Ann Lib Sci Docum, 1977, 24(3-4), 110-13.

13. Chan, Graham K L: The foreign language barrier in science and technology. Int Lib Rev, 1976, 8(3), 317-25.

14. Chan, Graham K L: Mushroom poisoning — thioctic acid and the foreign language barrier. Aslib Proc, 1977, 29(6), 237-40.

15. Chandler, George: Libraries, documentation and bibliography in the USSR, 1917-1971. London, Seminar Press, 1972.

15b. Commission of the European Communities: Better translation for better communication, a survey of the translation market . . . Oxford, Pergamon Press, 1983.

16. Corson, Janet E: Breaking the language barrier; a sociolinguistic perspective on online search strategy. 3rd International Online Information Meeting, London, 4-6 December, 1979, 123-37

17. Croitoru, A L: Role of scientific and technical translation in information transfer accross the language barrier; managing to meet translation needs at the National Institute for Information and Documentation (English and Rumanian). Probl Inf Docum, 1981, 15(4), 225-32.

18. Croitoru, A L: Some problems of scientific and technical translation. Probl Inf Docum, 1975, 9(3), 130-49.

19. D'Olier, Jacques H: Multilingualism in sceintific and technical documentation. Int Forum Inf Docum, 1977, 2(4), 20-24.

20. Dickson, A J: Librarians and the language barrier. Aslib Proc, 1979, 31(11), 438-54.

21. Diener, R A V: Transnational information flow as assessed by citation analysis. J Amer. Soc Inf Sci, 1979, 30(141-75.

22. Eisenhardt, Otto-Hermann: Journal of the American Society for Information Science versus Nachrichten fner Dokumentation (German). Nachr Dokum, 1979, 30(2), 81-85.

23. Ellen, Sandra R: Survey of foreign language problems facing the research worker. Interlending Rev, 1979, 7(2), 31-41.

24. Excerpta Medica (article in Encyclopedia of Library and Information Science).

25. Fondin, Hubert: The language of the scientific publication, the preponderance of English, and research (French). Documentation et Bibliotheques, 1979, 25(2), 59-69.

26. Foo-Kune, C F: Japanese scientific and technical periodicals, an analysis of their European language content. J Docum, 1970, 26(2), 111-19.

27. Frame, J D and Baum, J J : Cross-national information flows in basic research. J Amer Soc Inf Sci, 1978, 29, 247-52.

28. Gablot G, Besse, Bde and Michel J: La langue de publication de pays francophones. Study for Conseil de la Langue Francaise du Qnebec. 1981. *Quoted in* Michel J: Linguistic and political barriers in the international transfer of information in science and technology, J Inf Sci, 1982, 5(4), 131-35.

29. Gibbs, J M: Translation spotting in the European community (*In* Overcoming the language barrier. 3rd European Congress on Information Systems and Networks. Luxembourg, 3-6 May 1977). Munchen, Verlag Dokumentation, 1977.

30. Gibbs, J M and Phillips, E: Scientific and technical publishing in a multi-lingual society. (*In* Overcoming the language barrier. 3rd European Congress on Information Systems and Networks, Luxembourg, 3-6 May 1977). Munchen, Verlag Dokumentation, 1977.

31. Glover, Wendy: Services provided by Aslib relating to translation. Aslib Proc, 1979, 31(11), 529-29.

32. Gordon, M D and Santman, A: Language barriers, literature usage and the role of reviews; an international and interdisciplinary study. J Inf Sci, 1981, 3(4), 185-89.

33 Hanson, C W: The foreign language barrier in science and technology. London, Aslib, 1962.

34. Hanson, C W: Introduction to science-information work. London, Aslib, 1971.

34b. Hendricks, P V: Should we teach translation? Babel, 1975, 21(3), 101-106

35. Holmstorm, J E: The foreign language barrier. Aslib Proc, 1962, 14(12), 413-25.

36. Honoré, Suzanne: Index Translationum. Unesco J Inf Sci Librnship Archives Adm, 1980, II(2), 105-9.

37. Hunter, P S: Foreign language barrier — stumbling block or stepping stone? Inf Scientist, 1970, 4(2), 65-70.

38. Hutchins, W J: Machine translation and machine - aided translation. J Docum, 1978, 34(2), 119-59.

39. Hutchins, W J, Pargeter, I J and Saunders, W L. The language barrier, a study in depth of the place of foreign language materials in the research activity of an academic community. Postgraduate School of Librarianship and Information Science, University of Sheffield, 1971, (Summary published in J Librnship, 1971, 3(1), 1-25).

40. Ikhizama, B O: Use of foreign language literature in cereals research. Quart Bull IAALD, 1981, 26(2), 54-63.

41. Iljom, A: Scientific and technical data bases in a multilingual society. (In Overcoming the language barrier. 3rd European Congress on Information Systems and Networks, Luxembourg, 3-6 May 1977). Munchen, Verlag Dokumentation, 1977.

42. Inman, C R H: Scientific publications in English and developing countries; a report of a survey of scientists' experiences. J Inf Sci, 1983, 6(5), 159-64.

43. Jenkin, JG: Foreign languages and the university community; the University of Sheffield study of the language barrier. Aust Acad Res Lib, 1972, 3(1), 48-55.

44. Kertesz, F: Differences between the European and the American approach to overcoming the language barrier in science. 3rd European Congress on Information Systems and Networks: Overcoming the Languages Barrier, Luxembourg, 3-6 May 1977, Vol. 1, 271-91.

45. Kertesz, F: How to cope with the foreign language problem; experience gained at a multidisciplinary laboratory. J Amer Soc Inf Sci, 1974, 25(2), 86-104.

46. Kirkman, John, Snow, Christine and Watson, Ian: Controlled English as an alternative to multiple translations. IEEE Trans Profess Comm, 1978, PC21(4), 159-61.

47. Komatsu, S, Hara, O, Taoka, W: Overcoming the language barrier in Japan. 4th International Online Information Meeting, London, 9-11 December 1980, 187-94.

48. Kudryashova, L M, Golubeva, S V, Vlasova, T N and Davydora S L: Standardization in translation activity. Scientific and Technical Inf Processing (Nauchno-Technicheskaya INformatsiya, Seriya 1), 1982, No.6, 29-32.

49. Kunicki, M: La barriere linguistiqne, son importance et son evaluation. Documentaliste, 1980, 17(4-5), 147-50.

50. Large, J A: The foreign language barrier; problems in scientific communication, London, Deutsch, 1983. 196p.

51. Lawani, S M: The professional literature used by American and French agronomists and the implications for agronomic education.J Agronom Educ, 1977, 6,41-46.

52. Michel, J: Linguistic and political barriers in the international transfer of information in science and technology. J Inf Sci, 1982, 5(4), 131-35.

53. Mikhailov, A I: Overcoming barriers in international information exchange. FID Int Congress, Budapest 1972.

54. Morgan, B A: National bias in reference citation in English language agricultural engineering journals. Quart Bull IAALD, 1977, 22(3-4), 60-64.

55. National survey of translation needs of India. New Delhi, Dept. of Science and Technology and Indian Scientific Translators Association, 1982.

56. Pei, Mario A: Languages. *In* World Book, 1975.

57. Peters, E B: Cultural and language obstacles to information transfer in the scientific and technical field. Management Int Rev, 1975, 15(1), 75-88.

58. Rahman, A: A conceptual framework of history of science in India (*In* Science and Technology in Indian culture, a historical perspective. New Delhi, National Institute of Science, Technology and Development Studies, 1984).

59. Risseeuw, Mickey: Dissemination and marketing of information on existing translations. Int Forum Inf Docum, 1981, 6(4), 18-20.

60. Sable, Martin H: Language problem in comparative and international librarianship. Herald Lib Sci, 1978, 17(2-3), 139-41.

61. Schmidt, J M: Translation of periodical literature in plant pathology. Special Libs, 1979, 70(1), 12-17.

62. Science Information in Japan. Tokyo, Japan Documentation Society (NIPDOK), 1967.

63. Scott, P H: Technical translations, meeting the need. Aslib Proc, 1971, 23(2), 89-99.

64. Shipman, J C: . . . In the physical sciences. Wilson Lib Bull, 1966, 40(8), 706-13.

65. Tybulewicz, A: Cover-to-cover translations of Soviet scientific journals. Aslib Proc, 1970, 22(2), 55-62.

66. Unesco: Draft medium-term plan (1984-89). Paris, Unesco, 1982 (4XC/4).

67. Unesco: Scientific and technical translating and other aspects of the language problem. 1957.

68. UN, Centre on Transnational Corporations: Technical paper (Oct 4, 1982). Published as Transborder data flows, access to the international on-line data base market a technical paper. Inf Services and Use, 1982, 2(3-5), 1-129.

69. Van Bergeijk, D and Risseeuw, M: International Translations Centre, an example of cooperation to remove barriers to communication. Proceedings of the 8th meeting of IATUL, Enschede, May 28-June 1, 1979, 163-67.

70. Van Bergeijk, D: The language barrier in the provision of information (Dutch). Open, 1980, 12(6), 320-26.

71. Van Bergeijk, D: Language barriers still hamper the free flow of information. Information Politics: Proc of the 39th ASIS Annual Meeting, Vol 13, Oct 4-9, 1976.

72. Vom Bergeijk, D: Overcoming the language barrier in information transfer; the role of the International Translations Centre. Unesco J Inf Sci Librnship Archives Adm, 1981, 113(3), 173-77.

73. Van Bergeijk, D and Risseeuw, M: Organizational profile 2. the International Translations Centre; the language barrier in the dissemination of scientific information and the role of the ITC. J Inf Sci, 1980, 2(1), 37-42.

74. Wellisch, H: Linguistic and semantic problems in the use of English language information services in non-English speaking countries. Int Lib Rev, 1973, 5(2), 147-62.

75. Wood, D N: Access to information in foreign languages — an experiment. BLL Review, 1974, 2(1), 12-14.

76. Wood, D N: Foreign-language problem facing scientists and technologists in the United Kingdom — Report of a recent survey. J Docum, 1967, 23(2), 117-30.

77. Wood, D N: Translations. (*In* Mildren, KW: Use of engineering literature).

78. Yasmin, Nuzhat: Language barrier in dissemination of Scientific information. Pakistan Lib Bull, 1977, 8(1-2), 37-46.